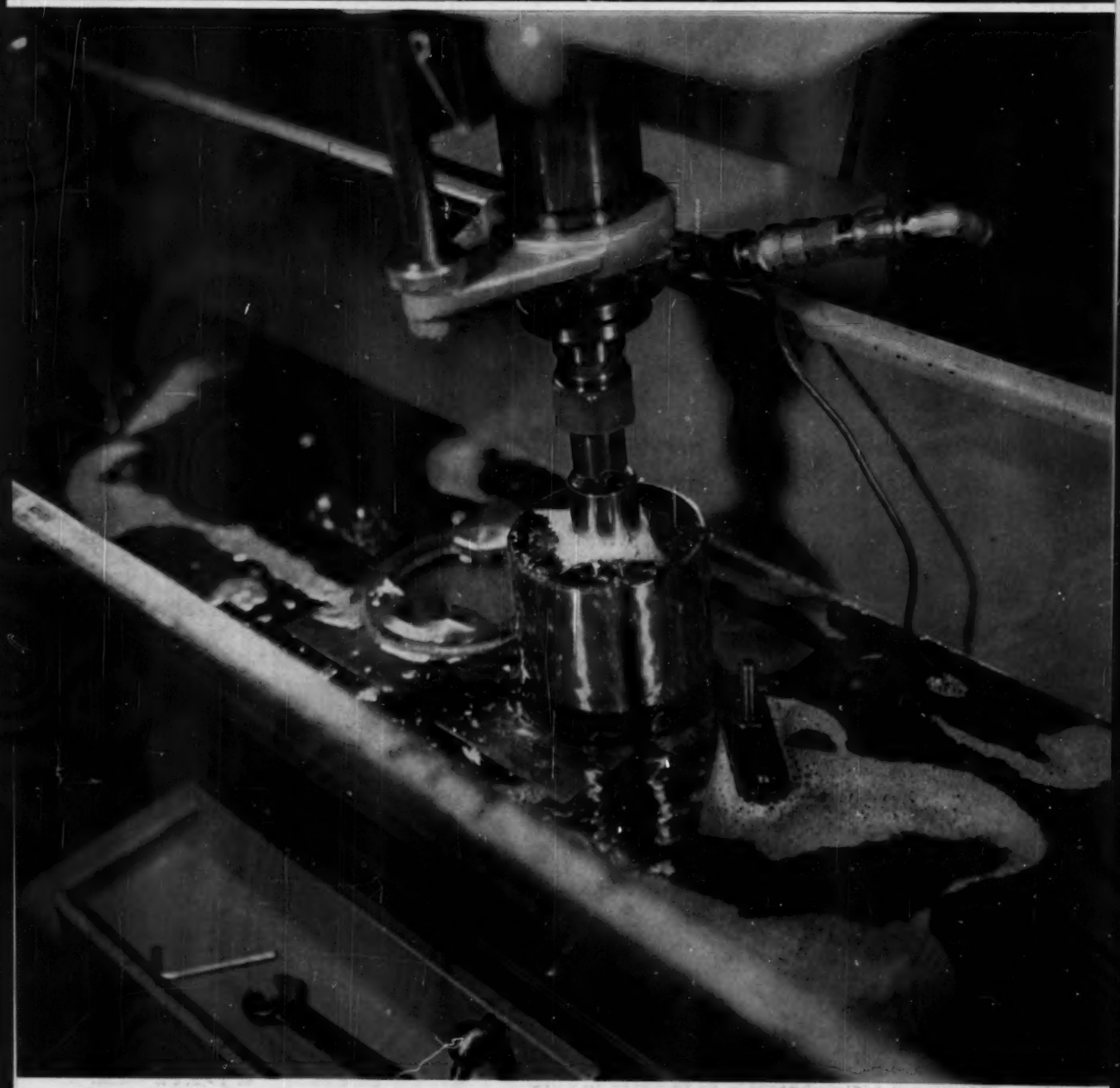
American Machinist

DECEMBER 29, 1958 75¢

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Challenge to straight-line flow

Page 57



Cutting internal shoulders on gyro case for next moon shoot—page 43

Here's Why

BORE-MATIC VERSATILITY SAVES MONEY

on Any Automated Production Line

When the time comes for a job changeover, you can do it at a saving with Heald Bore-Matics

Heald Slide Units Simplify Automation

The Heald *Slide-Unit* is the basic "building block" of an automated Bore-Matic production line. This simple, compact, hydraulically operated unit, complete with boringhead and drive, can be mounted in any position and can approach the work from any angle. It can be tooled for any desired operations — from roughing to precision finishing.

Because each Slide Unit is a separate and completely self-contained machine—arranged through interlocking control circuits to function as a fully automatic segment of the entire production line — individual machines can be added as required.

THE versatility of a Heald Bore-Matic has often been cited in terms of the machine's ability to perform a number of operations simultaneously. But this basic versatility has another advantage—one that is particularly important where large, automated equipment is involved. It *protects your investment* against the danger of early obsolescence!

For example, a Heald automated production line consists of the required number of *basically standard* Bore-Matics — tooled up to perform the required operations on a specific part. The machine becomes "special" only where part design requires it. Upon completion of the job for which the machine was designed, it can usually be re-tooled and put to work on a brand new operation — with a minimum of structural changes. This simplicity and economy of job changeover eliminates much of the "risk" in planning a long-term investment in automated equipment.

If you want a production line that's *protected against obsolescence*, talk to your Heald representative about Multi-Unit Bore-Matics, another example of why *It Pays To Come To Heald.*

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THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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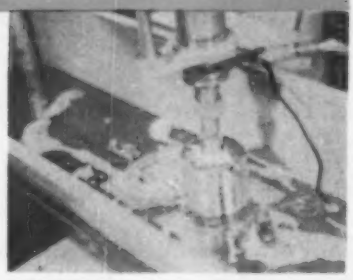

Aiming for the moon... The Elox machine shown operating on our cover is at Ford Instrument Co, Division of Sperry Rand Corp. It is unusual both because the part being made is for the guidance system of the moon rocket and because it is one of the rare cases in which an electrical-discharge operation is not completely submerged in electrolyte. Actually the work is on internal shoulders and this working area is flooded. The contoured cast tool is fed in to replace milling on a difficult operation. The method reduces time 70% and produces a better finish. Details of this and other tooling at Ford Instrument are in the article on page 43.

Line efficiency... It is usually accepted today that straight-line production is most efficient. But at GM's Electro-Motive Division, the trend has been reversed. According to Warren Hrstka, who heads methods engineering, bottlenecks were avoided, overtime and waiting time reduced, by shuttling work back and forth with operators performing several different operations. You'll find the experience described in the article on page 57.

Holiday bouquet... Because this issue reaches you between two major holidays we've packed it with short articles, each high in idea content. It won't take you long, and won't make you late for the next budget conference, but it will leave you with some rewarding information that makes it worth fitting into your busy schedule.

With this issue we round out our 81st year. It has been a tough year for most of the metalworking industries, but it has been a year packed with developments worth watching—and doing something about. As you enter 1959 you are expecting your business to pick up and to be busier than ever. At the same time you are going to need more than ever to be able to pick up quickly and effectively the ideas that will help you produce more, or better, or cheaper.

Joint Resolution: We have resolved to try even harder to distinguish between the significant and the trivial, to concentrate even harder on assembling an idea package that is useful—and easy to use. Why don't you resolve now to be even more alert for the ideas that will help your production in 1959, and even more conscientious about taking quick action to put them into practice.

Cover...

Electric-discharge machining produces rib contours inside a gyro cylinder for Jupiter and Juno missiles. Details at left.

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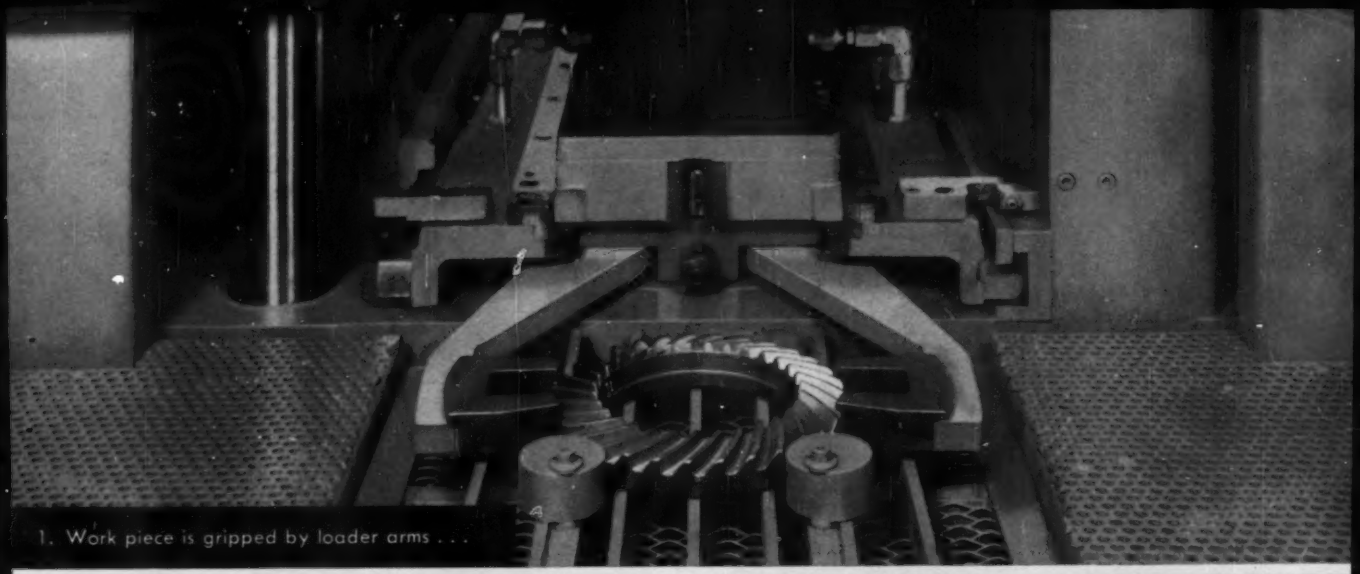
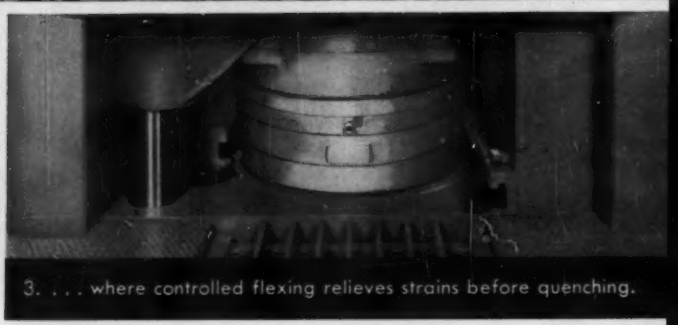


1. Work piece is gripped by loader arms . . .

2. . . . which move piece to quenching die . . .



3. . . . where controlled flexing relieves strains before quenching.

New Gleason machine quenches gears *3 times faster* with minimum distortion

The unique, fully automatic method incorporated into the new Gleason No. 117 Quenching Machine makes it possible to quench gears and other parts faster than ever before without significant distortion.

The machine discharges a piece every 30 seconds; accommodates 17 pieces in process at one time.

Automatic handling. Once a part is deposited at the front of the machine, the No. 117 positions it on a quenching die and then clamps, flexes, and quenches it. Initial quenching takes only about ten seconds.

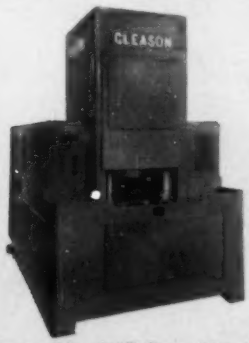
When the part cools past the critical hardening temperature, it is released from the dies. Still immersed in oil, the part then cools completely as it travels on a conveyor to the unload chute. As soon as part is released from dies, the machine is ready to receive another work piece.

Flexing before quenching. Each hot part is flexed between the dies to relieve internal stresses. Rate and number of flexes are easily preset. Hydraulic pressure produces positive diaphragming action.

Pulsing. All pressure on the work is pulsed momentarily throughout the die-quench. This permits work to contract without strain. During the die-quench, oil flows uniformly over and around the part.

Faster production. You can speed up production materially with the Gleason No. 117 Quenching Machine. It handles ring gears and cylindrical parts up to 10½" in diameter and 8" high. You can connect it with any conventional furnace so that parts are automatically fed to the quenching press. Push-button controls and timers are adjustable and easy to set. Dies can be changed quickly and easily.

Gleason engineers are ready to help you step up productivity with this new machine. For complete details, write for bulletin.



Gleason No. 117 Quenching Machine

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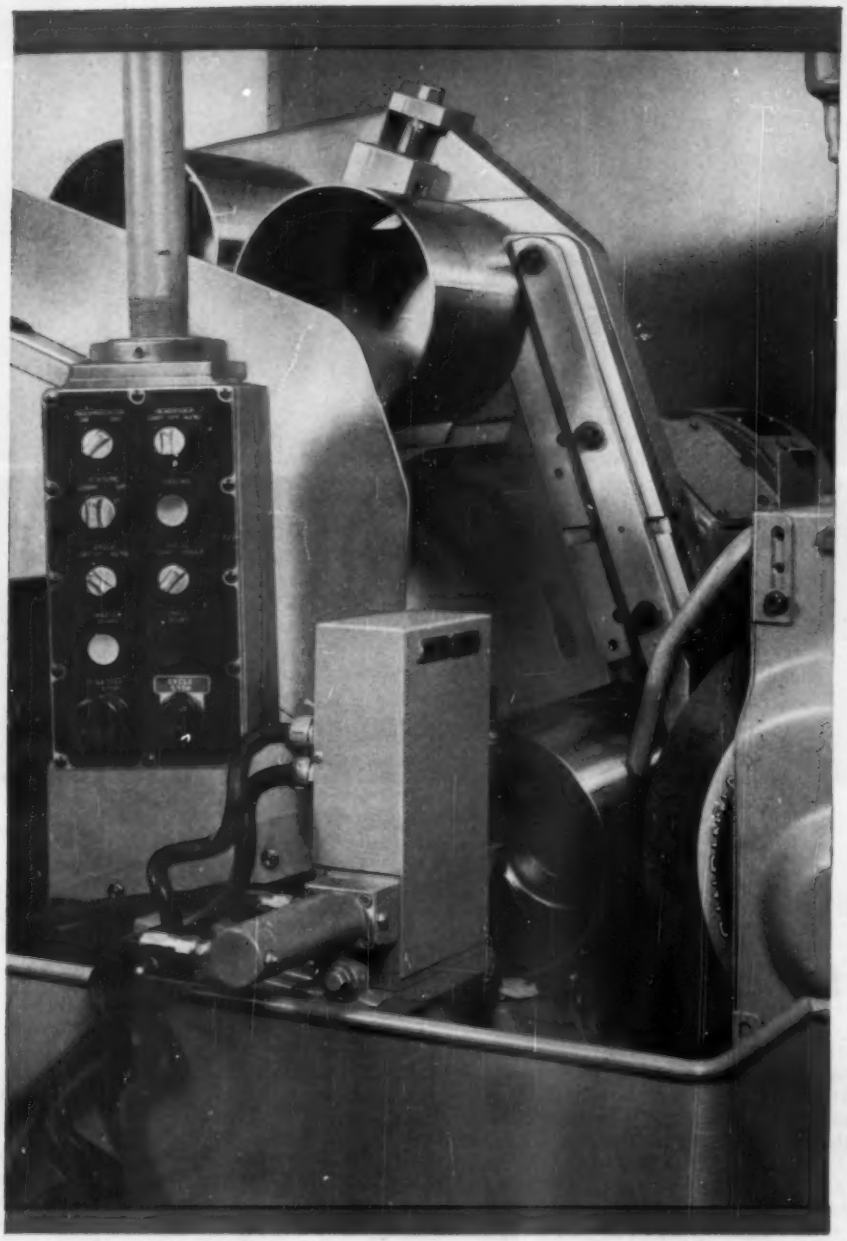

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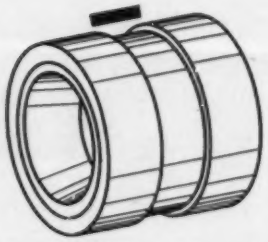

Drawing of part. Diameter ground is indicated by heavy line.

Part name . . . . anti-friction ring

Production . . . . 40 per hour for 10" rings

FILMATIC

Micro-Centric grinding applied to large parts up to 10" diameter. Loading and grinding are automatic for the operation of grinding a narrow section to perfect roundness.

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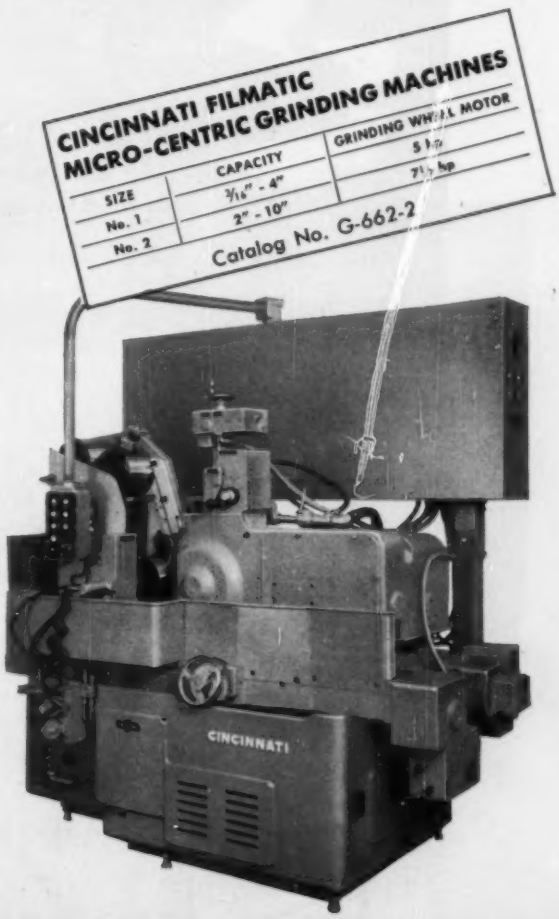
Anti-Friction Bearing Rings

are ground perfectly round

on the Cincinnati Filmatic Micro-Centric

Perfect roundness is a tough specification for any high production grinding operation. And the larger the part, the more difficult the specification becomes for ordinary grinding methods. A prominent manufacturer of anti-friction bearings solved the problem by enlisting the aid of Cincinnati Grinding and Automation Specialists, and performing the job of grinding the center section of 10" diameter rings on a CINCINNATI® FILMATIC No. 2 Micro-Centric. ¶The machine is tooled up for automatic production, and includes several cost-reducing features such as automatic loading fixture, adjustable for 6" to 10" diameter range . . . automatic reciprocation for grinding wheel spindle with interlock for truing . . . automatic cross feed compensation to maintain constant length of cycle. ¶This equipment is typical of the fine grinding machines and modern tooling available at Cincinnati. Our specialists are ready to give you the benefit of their experience in six distinct types of precision grinding: centertype, centerless, chucking, Micro-Centric, centerless lapping, roll. Make Cincinnati your headquarters for fine standard and special precision grinding machines. It's to your advantage to do so.



GRINDING MACHINES • ROLL GRINDING MACHINES
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GRINDING MACHINE DIVISION
The Cincinnati Milling Machine Co.
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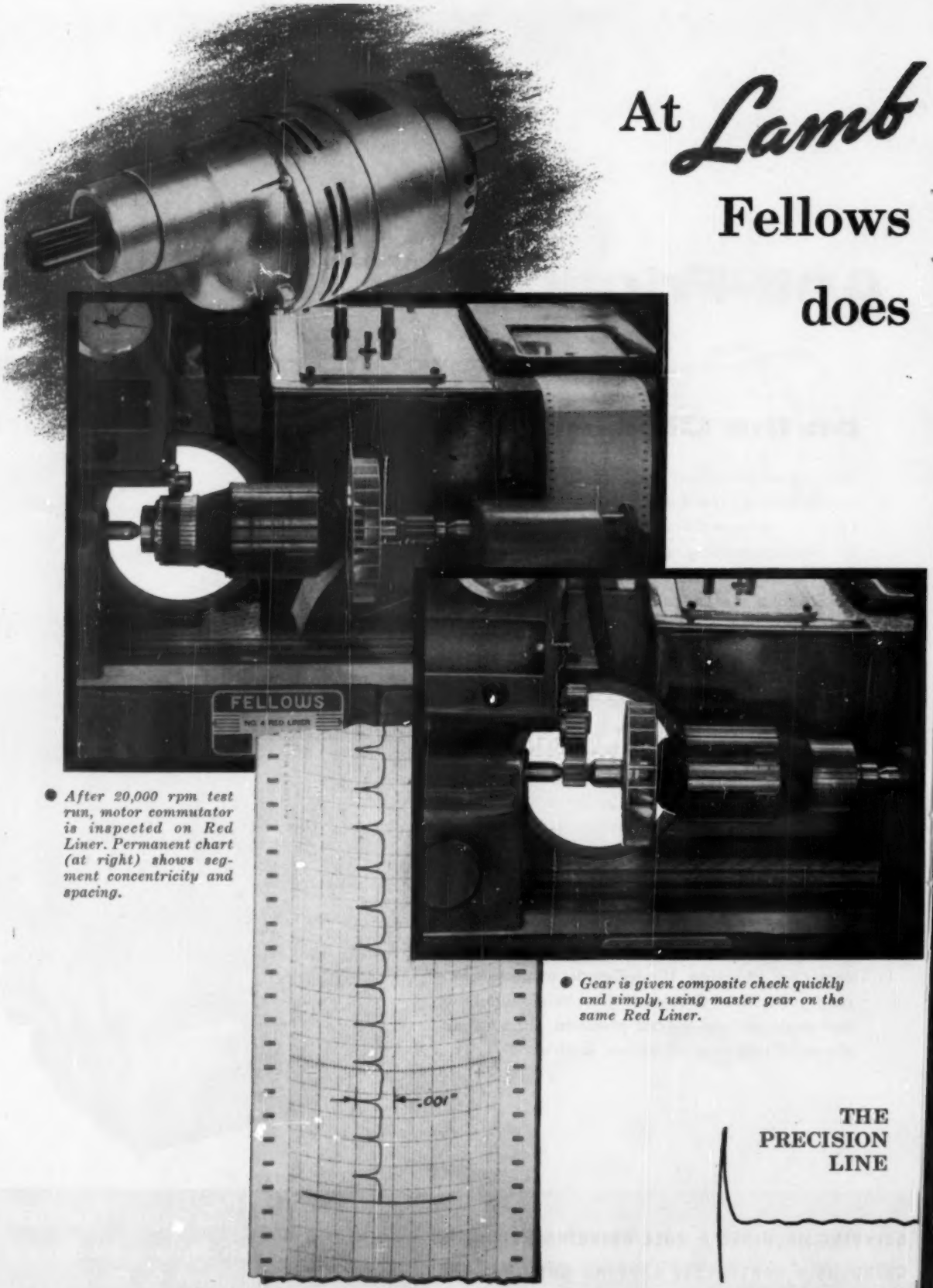
At *Lamb* Fellows does



● *After 20,000 rpm test run, motor commutator is inspected on Red Liner. Permanent chart (at right) shows segment concentricity and spacing.*

● *Gear is given composite check quickly and simply, using master gear on the same Red Liner.*

THE PRECISION LINE

Electric

Inspection Instrument DOUBLE DUTY!

Here's an example of a gear inspection instrument that's also proved ideal for other inspection uses! At the Lamb Electric Company, Kent, Ohio, a standard Fellows No. 4 Fine Pitch Red Liner checks pinions for high speed gear-motors... and inspects the motor commutators too.

When checking commutators for concentricity and spacing of segments, Lamb Electric substitute a ground disk on the master spindle for the master gear ordinarily used. Inspection is fast and accurate. Commutators are checked after baking and after each high speed test. The permanent chart made by the Red Liner permits easy comparison of successive test results.

The low output speed, high torque gear-motors manufactured by Lamb Electric demand precision in every detail. Gears are produced on a Fellows 3" Fine Pitch Gear Shaper and inspected on one of four Fellows inspection instruments, with consistently excellent results in production speed and accuracy.

For full information about the complete Precision Line of Fellows gear production equipment, get in touch with your Fellows representative. Contact any Fellows office.

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78 River Street, Springfield, Vermont
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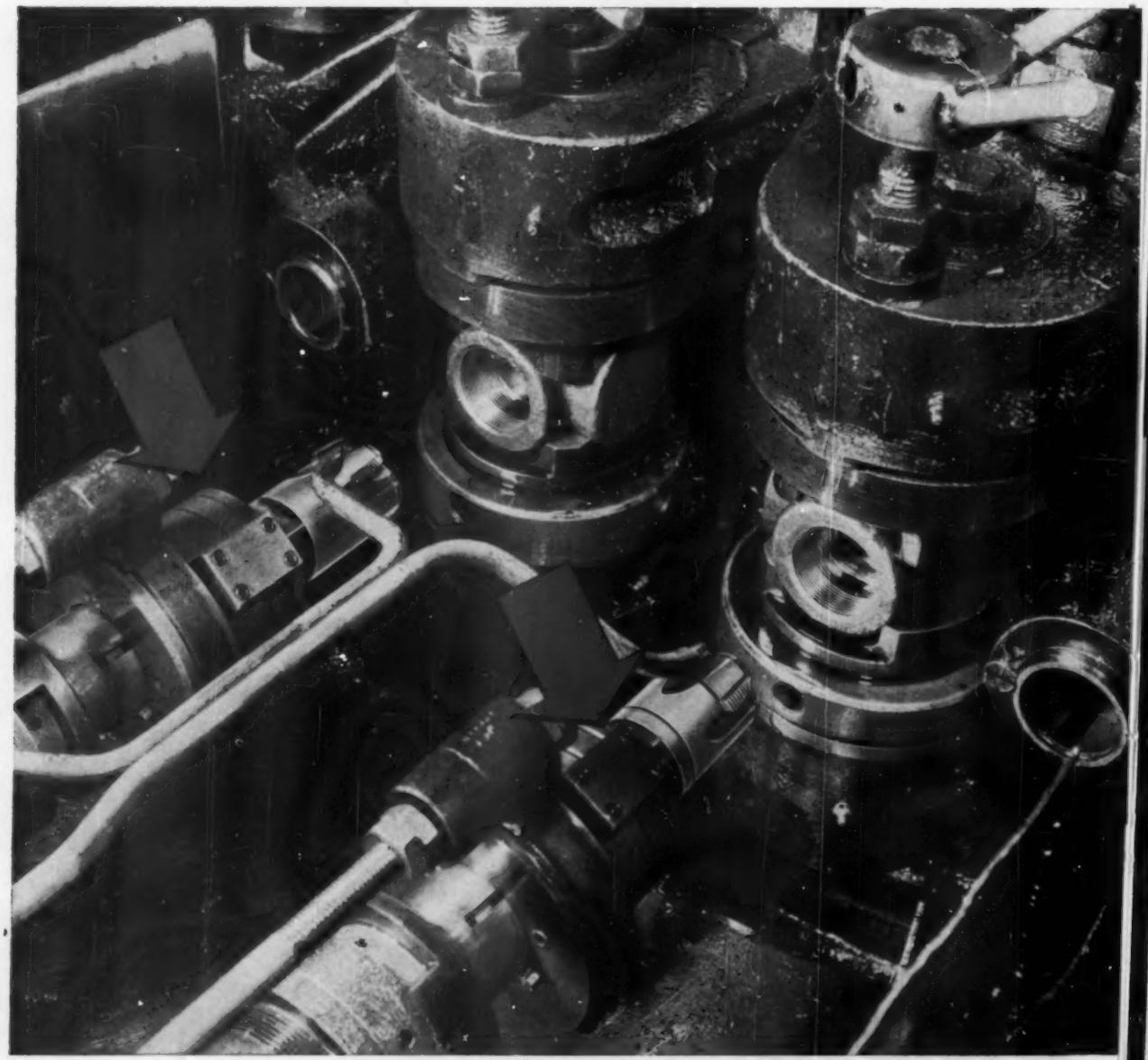
Fellows No. 4 Fine-Pitch Red Liner

Fellows *Gear Production Equipment*



TAPERED THREADS

produced with *LOW* Tool Cost

by receding *TAP*

"Receding action" enables the LANDIS LL Tap to thread 4000 W-S pipe fittings per grind at production rates to close tolerances.

This action produces a tapered thread of great accuracy because it mechanically withdraws the chasers from the work at a rate equal to the taper of the thread being produced. Cutting strains are reduced, a true conical thread produced, thread finish improved, and chaser life lengthened.

W-S pipe fittings are produced by the H. K. Porter Company, Inc., Forge & Fittings Div. W-S Fittings Works, Roselle, N. J., for high pressure pipe lines. In the particular operation illustrated, two LANDIS LL Rotary Taps on a special drilling and tapping machine are threading Forged Steel Pipe Elbows. 2" 11½ pitch ASTP threads are tapped at 35 s.f.m.—with 4000 threads completed between chaser grinds.

The LL Tap is also well-suited for threading Stainless Steel. Its cutting action is limited to the throat section or chamfer of the chaser, tapping the thread quickly with little cold-working. As on all LANDIS Taps, detachable heads allow each size of Tap Body to produce a wide range of thread diameters.

For further information, send specifications and ask for Bulletin G-95.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

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Exclusive features make Landis universal grinders a "best buy"

Here's where they will save time... reduce grinding costs:

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Landis 10" x 20" Type H Precision Universal Grinder

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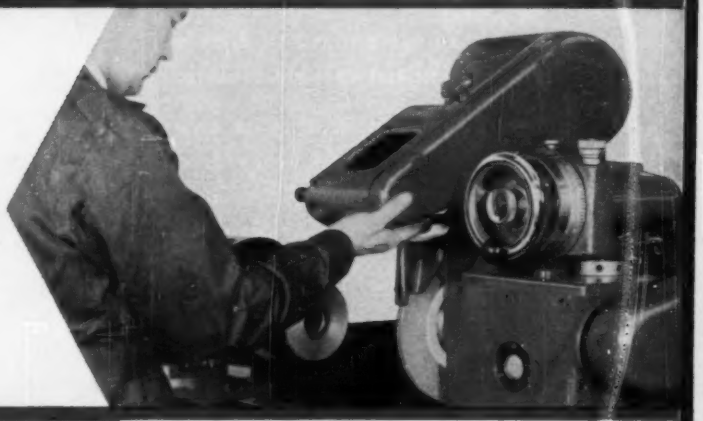
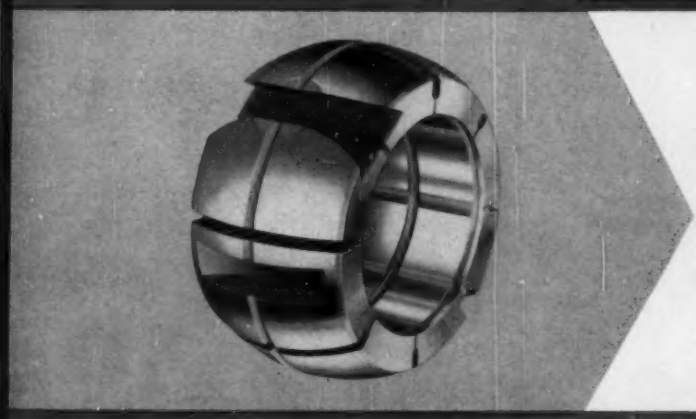
Fully universal wheelhead for fast setup

Easy hand swiveling with exclusive Landis wheelhead swivel mechanism.

Swinging internal grinding fixture for fast *change* of setup

Quickly lowers for internal grinding; locks securely and rigidly; swings up out of the way; no exposed belts.





Microsphere bearings for close tolerances and fine finishes

Closest running clearance of any spindle bearing; gives sensitive response to wheel feed, quick sparkout, dependable operation.

Fully universal headstock for ease of operation

Compact, low design; only two revolving parts. Variable speed control by rheostat. Swivels for angle or face grinding.

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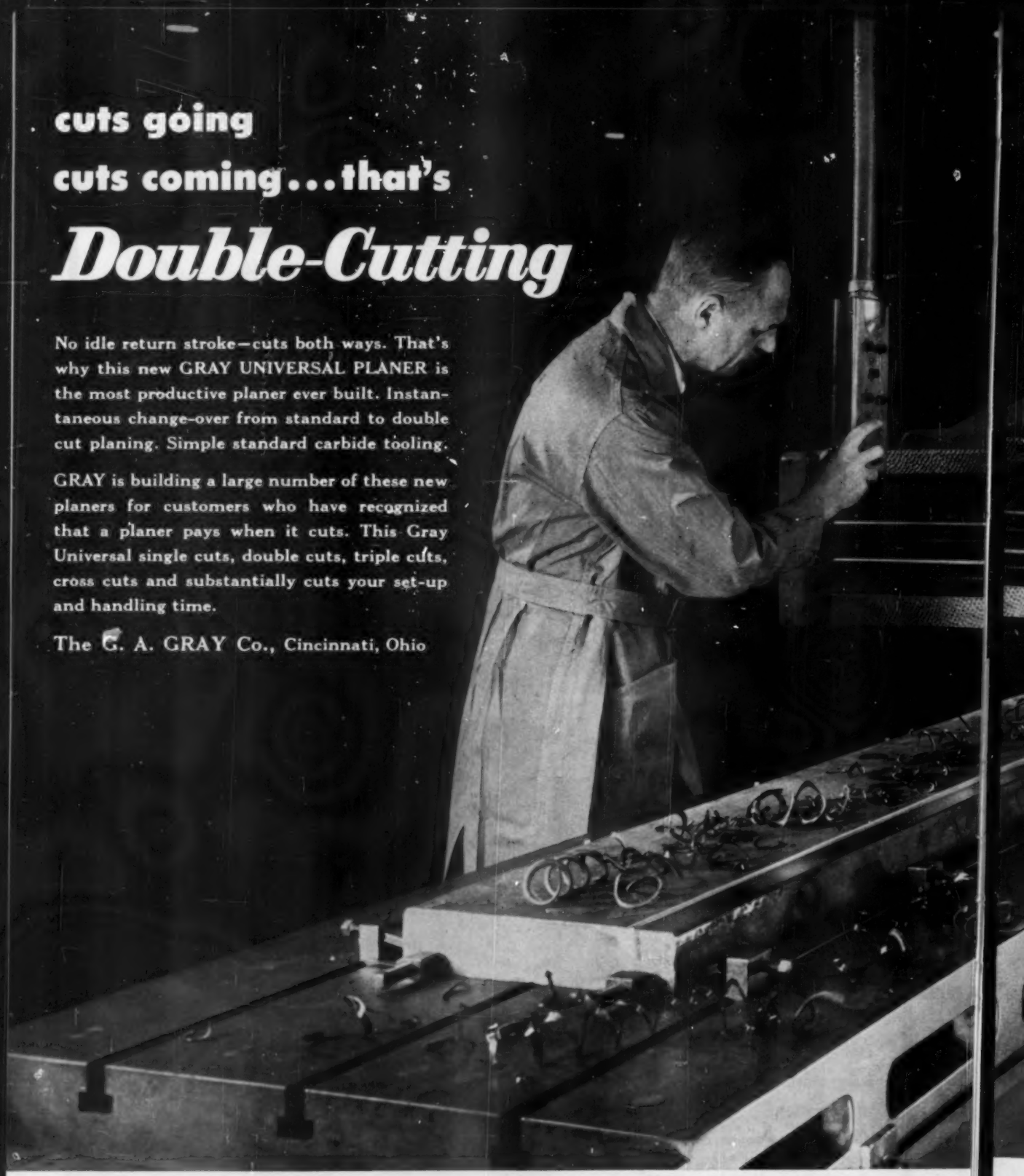
cuts going
cuts coming...that's
Double-Cutting

No idle return stroke—cuts both ways. That's why this new GRAY UNIVERSAL PLANER is the most productive planer ever built. Instantaneous change-over from standard to double cut planing. Simple standard carbide tooling.

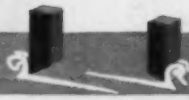
GRAY is building a large number of these new planers for customers who have recognized that a planer pays when it cuts. This Gray Universal single cuts, double cuts, triple cuts, cross cuts and substantially cuts your set-up and handling time.

The G. A. GRAY Co., Cincinnati, Ohio



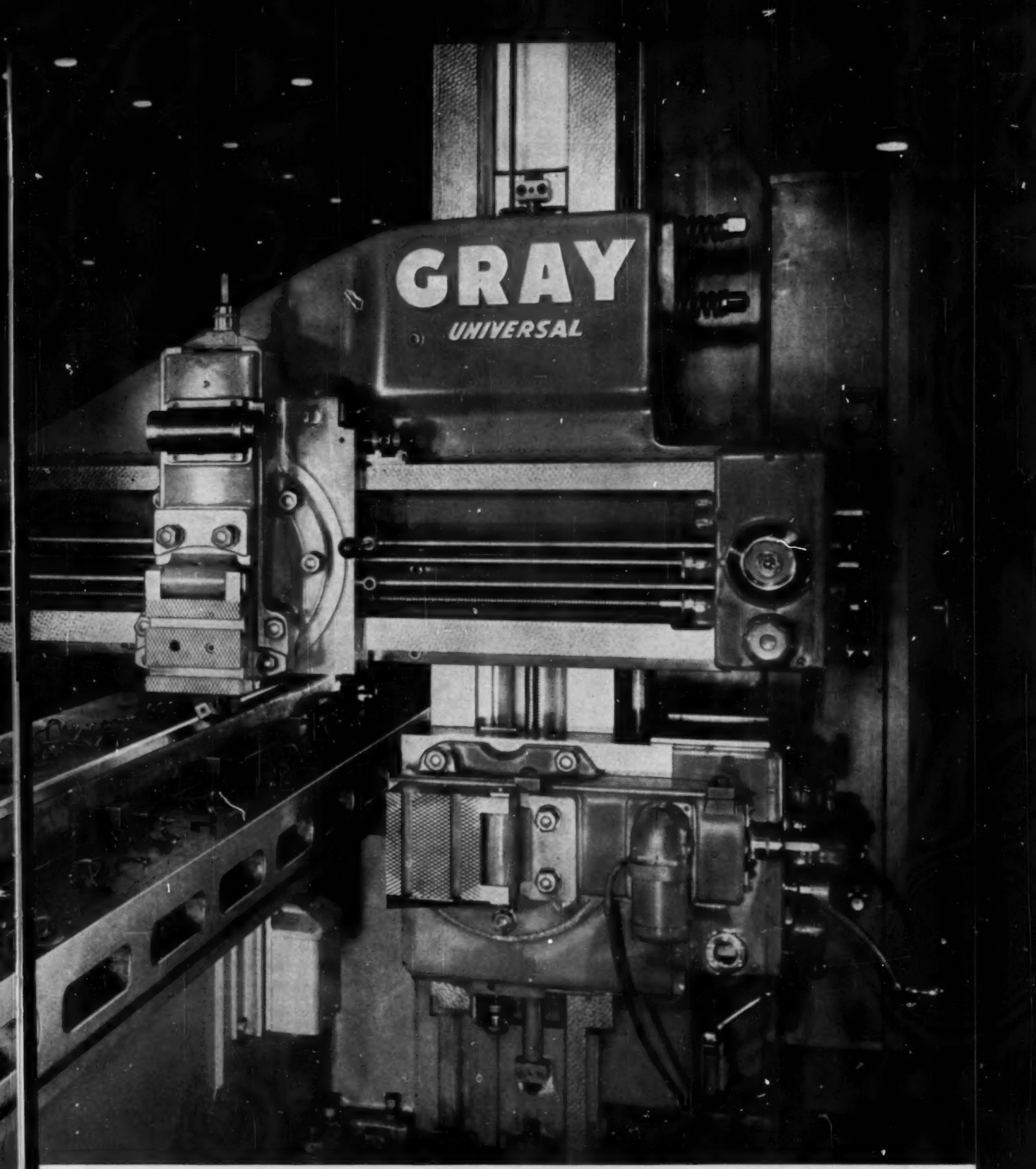
heavy-duty planing

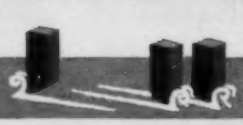
The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.



double cut planing

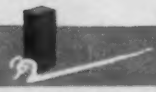
The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.





triple cut planing

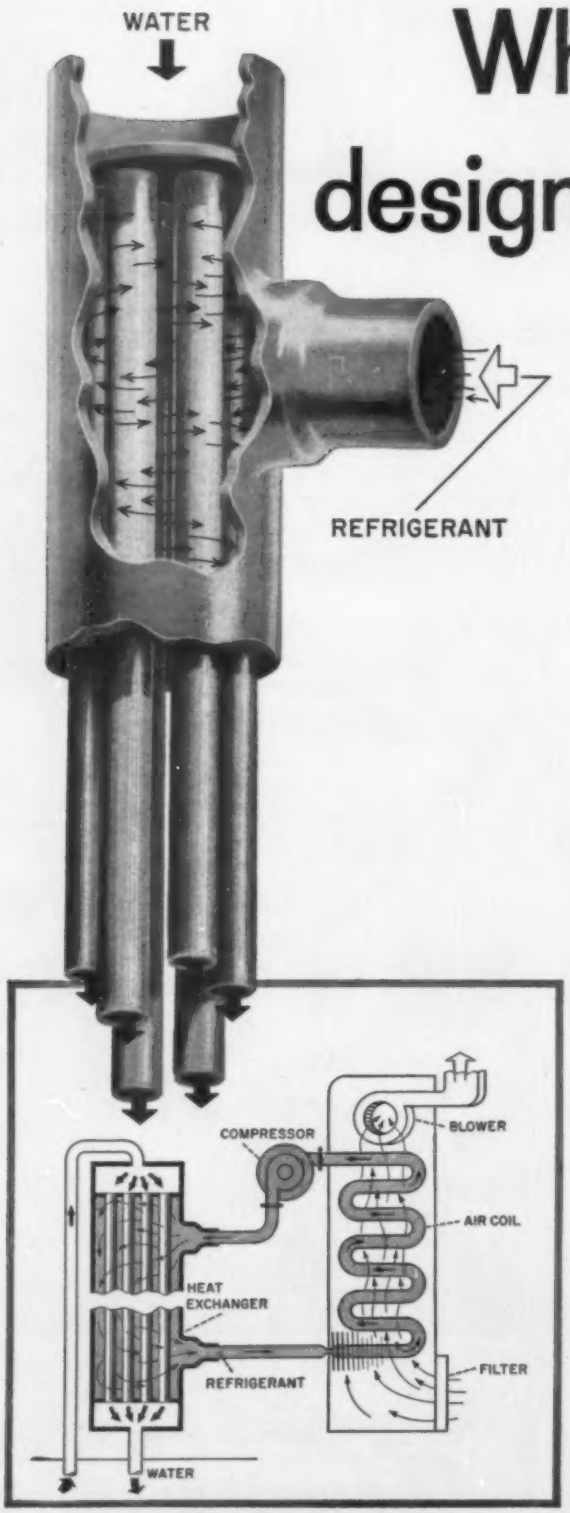
Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.



cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

What are today's design possibilities?



Design possibilities with the copper metals are as varied as these metals themselves. The forty-two industry standard alloys and the hundreds of special copper alloys offer combinations of electrical, thermal, chemical, structural, joining and finishing properties which are more valuable in this day of rigid performance specifications than ever before.

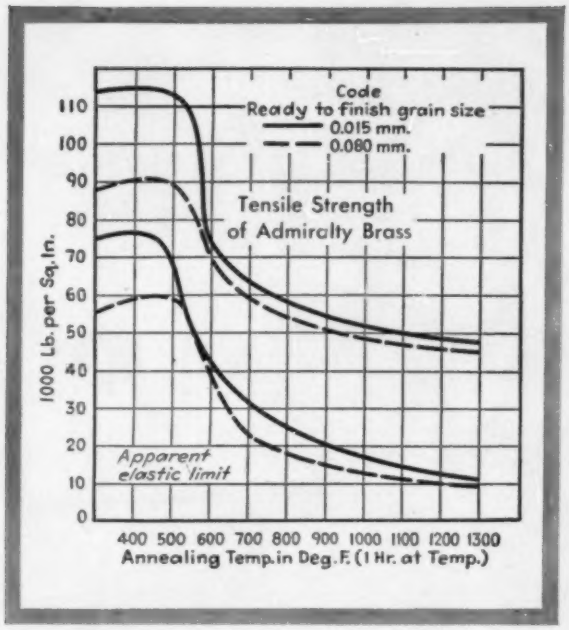
Today, most parts must meet several material requirements. Even a fastener, in addition to strength, may need corrosion resistant and high-finish properties. A supporting member may also have to conduct heat. Efficiency calls for materials versatility. And versatility calls for the copper metals. Although used since 7500 BC, copper is being re-examined as a new material with design possibilities that have scarcely been tapped. Here are some of the problems, and some of the properties that have special meaning at this time:

Design Problem — Heat pump condenser

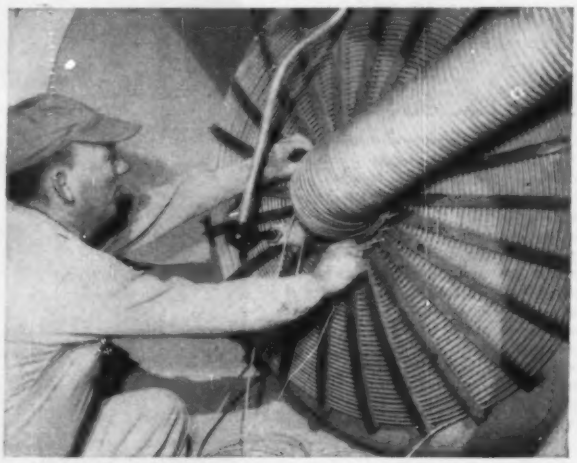
The tube-in-tube condenser in a Typhoon Heat Pump must transfer heat between the ground water and the recirculating refrigerant. Corrosive sodium and sulphur compounds are dissolved in the ground water. The refrigerant, being highly volatile, must be confined in a leakproof system. The house air must be heated in winter and cooled in summer by passing over heat-transfer coils. The design requirements, then, include corrosion resistance, heat conductance and impermeability to the refrigerant. These requirements are met by three forms of copper. The ground water is contained in Admiralty Brass because of its excellent resistance to salt and sulphur corrosion. The refrigerant is contained in commercially-pure copper because of its density and the impermeability of its soldered joints. The air coil is a tinned copper fin soldered to a copper tube for maximum heat transfer at a realistic cost.

The good heat conductivity of copper and Admiralty Brass is, of course, important. But the conductivity of the metals themselves would be of little use if they did not also resist corrosion. The reason for this (besides durability) is because a heavy layer of corrosion products would severely reduce transfer efficiency.

TYPHOON HEAT PUMP CONDENSER SECTION (shown actual size). Heat exchange between ground water and refrigerant is accomplished in this unit. The corrosion resistance and high heat conductance of the copper metals used are vital to efficient operation. Drawing at bottom shows the complete cycles schematically.



← **EFFECT OF ANNEALING ON TENSILE STRENGTH** and apparent elastic limit of admiralty-metal strip, previously cold-rolled 6 B. & S Nos. (50% reduction of area) from two different grain sizes, 0.015 and 0.080 mm. (0.040-in. stock).



COPPER COILS being installed on the bottom of the main core vessel of the Organic Moderated Reactor Experiment.

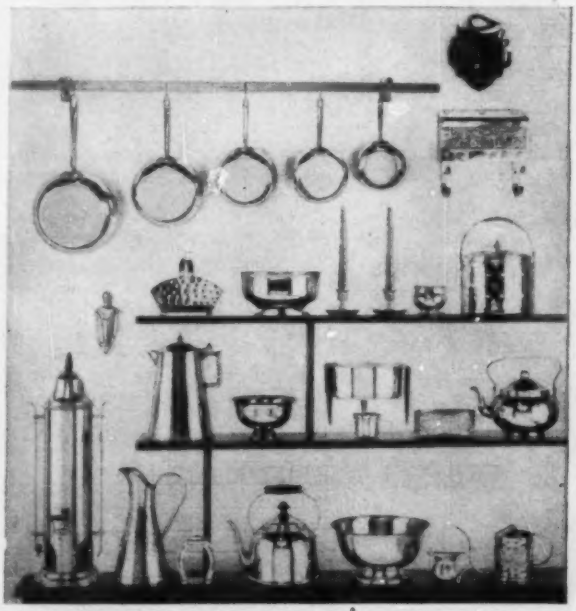
As with any piping system, impact and tensile strengths of the groundwater tubing are also important. Slight shifts in the substrata can produce heavy stresses. Admiralty Brass, as manufactured for this tubing, develops a tensile strength of the order of 45,000 psi. Many copper alloys are even stronger. The high-zinc brasses, nickel silvers, beryllium copper, the silicon bronzes and the phosphor bronzes can be processed to provide tensile strengths of the order of 140,000 psi for hard-drawn wire. Strengths, of course, vary with temper. The graph above illustrates the range of strengths for Admiralty Brass.

Design Problem — Preheating for atomic reactor

The induction heating coils used in the Organic Moderated Reactor Experiment, a nuclear power project operated by Atomics International, a division of North American Aviation, Inc., for the Atomic Energy Commission, keep the organic moderating compound in a fluid state during reactor startup and shutdown. The necessary high temperatures are generated by eddy currents in the reactor tank. The design requirements for the coils were high electrical conductivity and good high-temperature characteristics. Oxygen-free, high-conductivity copper was the answer. Its freedom from impurities assures high conductivity and guards against high temperature oxidation and scaling.

Design Problem—Yours

The combination of properties that you need for today's multifunction design requirements can probably be found among the copper metals. The copper industry will help you find it. The Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y., will welcome your inquiry.



FINISHING REQUIREMENTS. The nickel silvers and low-zinc brasses are widely used in ornamental applications because of their ease of plating and finishing as well as their cold-working properties. The new fine-grain brasses offer an ideal surface structure for economical high finish.

The picture above shows various combinations of coppers and brasses used decoratively in housewares.

THERE'S A NEW FRONTIER IN...

COPPER · BRASS · BRONZE

Modern celestial navigation systems for sophisticated jet bombers use the Simulacrum astro-tracker test table pictured above. The Alignment Fixture for this intricate instrument establishes a point to simulate a star . . . and the alignment calibration must be accurate to one second of arc, for an error as small as one second could result in serious inaccuracies. Consequently, the machining of the Alignment Fixture must be accomplished with extreme precision, as pictured in the finish milling of the critical bearing surfaces at the B. G. Instrument Corporation of Corona, New York.

When the job consists of a variety of operations on so critical a part as the Alignment Fixture for the Simulacrum, it is all but mandatory to machine it on the SIP HYDROPTIC. For work of this character, the ultimate in precision is maintained . . . axial centers must be absolutely "dead accurate" (within a tenth) . . . and all bores and locating surfaces must be within an accumulated error not exceeding 0.0005".

Here you see the machining of this Fixture in progress—on the SIP HYDROPTIC 6A Jig Boring and Milling Machine . . . in the temperature-controlled jig boring room of the B. G. Instrument Corporation of Corona, New York.

In the new series of HYDROPTICS . . . featuring greater ease of operation, increased range and capacity, and a guaranteed visual accuracy of 0.00015" . . . the basic Precision that is SIP assures confidence whenever critically accurate machining is demanded. Catalog No. 1149 tells the complete story of the SIP HYDROPTIC 6A; send for it.

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excellent accuracy, duplicating to less than .001". . . clean front and ease of conversion to regular or Copymatic operation are outstanding . . . removing 15 to 30% more metal than our best (lathes) — twice that of some.

MACHINE TOOL BUILDER

82% time saved . . .

MACHINING SUBCONTRACTOR

Saving

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82%

AIRCRAFT SUBCONTRACTOR

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ELECTRONICS MANUFACTURER

Production increased 200%

Shown is 90° COPYMATIC Lathe with 4-Way Power Rapid Traverse, (optional extra). 45° COPYMATIC and Powershift Preselector headstock also available.

HOW TO JUSTIFY YOUR LATHE REPLACEMENT

LOOK AT LODGE & SHIPLEY FIRST!

More production at lower cost is the answer to constant upward pressure on prices. Savings proved in Lodge & Shipley case histories* show the wisdom of investigating *and* buying a Lodge & Shipley POWERTURN Lathe as a profitable replacement.

Production requirements change. The lathe purchased just a short time ago may not be adequate . . . judged by today's production, accuracy and economic standards. Details in Sweet's Machine Tool File; contact local representative through Yellow Pages or write direct for case histories and Bulletin No. L-103:

The Lodge & Shipley Co., 3056 Colerain Avenue, Cincinnati 25, Ohio.

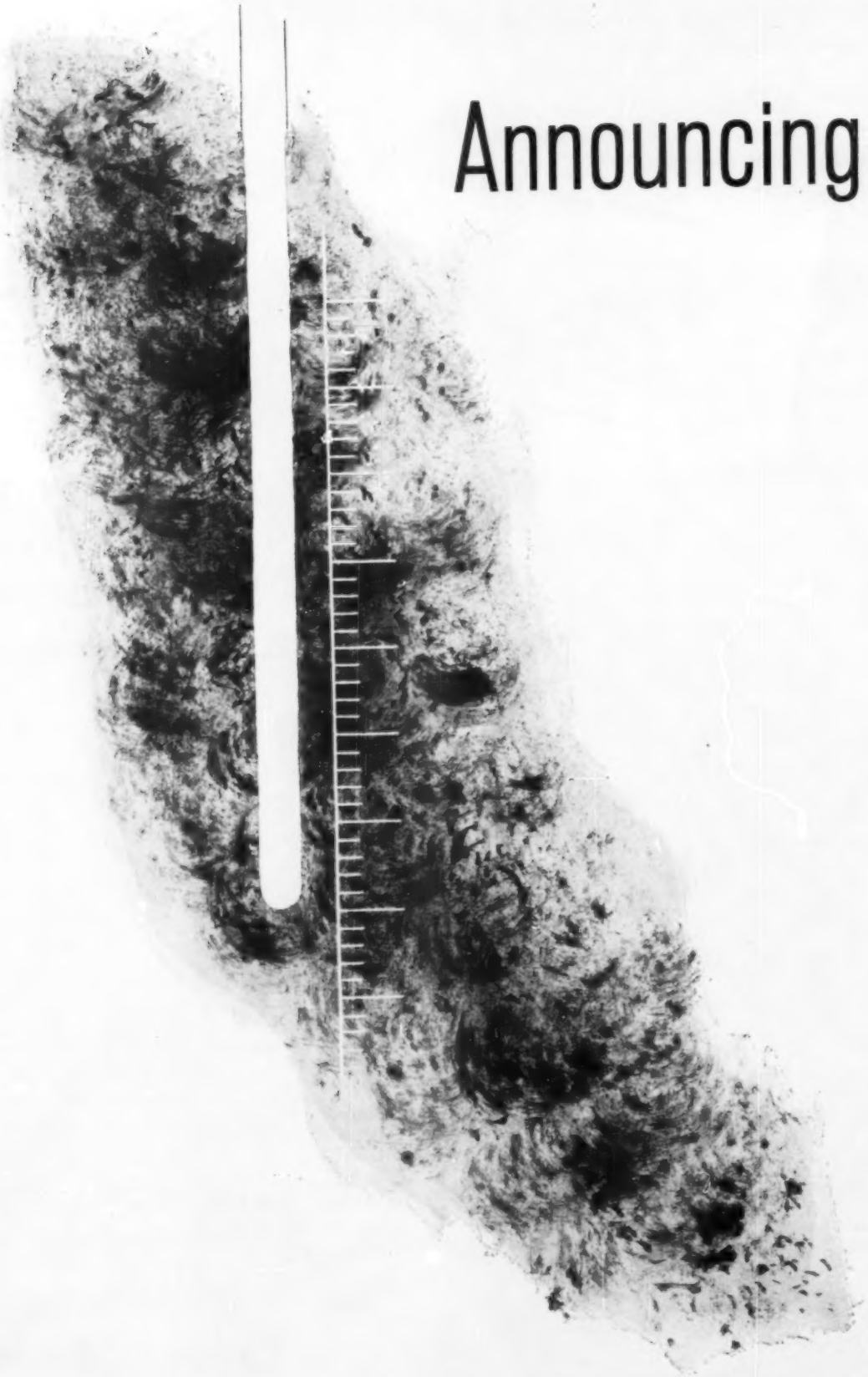
**Names and details on request.*

Lodge & Shipley

◀ CIRCLE 184 READER SERVICE CARD

CIRCLE 185 READER SERVICE CARD 17

Announcing...



USS 9% Nickel Alloy Steel

for the world's coldest applications down to -320°F

Nothing gets much colder than liquid nitrogen, which exists at temperatures of minus 320° F and below. At such temperatures, most container materials get brittle —lose their toughness.

To meet the need for an economical material that can be used for low-temperature pressure vessels, U. S. Steel is making an alloy steel containing 9% nickel. This steel is stronger, tougher and less expensive than other metals used for handling liquefied gases such as methane, oxygen, and nitrogen. For test purposes, plates in thicknesses of ¼ and ½ inch are ready for immediate delivery. Sheet sizes and heavier plates, as well as structural shapes, bars, and semi-finished products, are also available upon inquiry.

Higher Strength. USS 9% Nickel Steel can be furnished to meet all requirements of ASTM Specification A-353, Grades A or B. The ASME Boiler and Pressure Vessel Code allows a maximum working stress of 22,500 psi for 9% Nickel Steel. This is about 17% higher than allowed for other metals used for this purpose.

Greater Toughness. The toughness of 9% Nickel Steel has been well established in drop tests of actual vessels containing liquid nitrogen at minus 320° F. Charpy keyhole-notch impact values have been observed to be as high as from 31 to 38 ft.-lbs. at minus 320° F, from 73 to 84 ft.-lbs. at room temperature.

Weldability. Joints of 100% efficiency are possible with either manual or automatic welding in the inert gas metal-arc process. Suitable welding rods are available.

Weight Reduction. Greater strength permits USS 9% Nickel Steel to be used in thinner sections with substantial weight reduction. This is important for stationary storage and shipboard storage tanks for methane—and for other severe low-temperature storage applications.

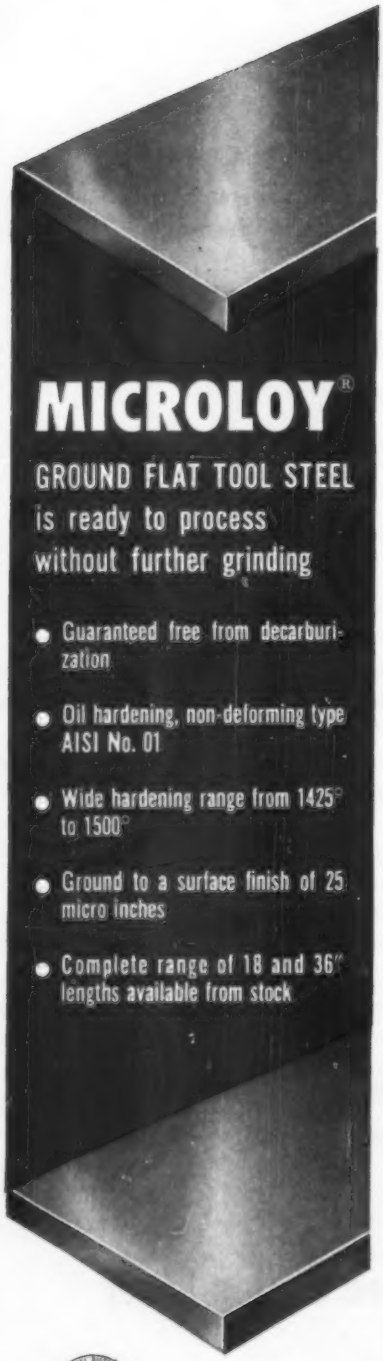
Lower Costs. The steel itself costs less than competing materials by about 40%—and products such as tanks and heads can be made stronger with less material.

We urge you to consider USS 9% Nickel Steel for better, less expensive low-temperature vessels.

USS is a registered trademark

United States Steel Corporation — Pittsburgh
Columbia-Geneva Steel — San Francisco
Tennessee Coal & Iron — Fairfield, Alabama
United States Steel Supply — Steel Service Centers
United States Steel Export Company

USS United States Steel


MICROLOY®
GROUND FLAT TOOL STEEL
is ready to process
without further grinding
• Guaranteed free from decarburization
• Oil hardening, non-deforming type AISI No. 01
• Wide hardening range from 1425° to 1500°
• Ground to a surface finish of 25 micro inches
• Complete range of 18 and 36" lengths available from stock

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CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Inventory

Dear Sirs:
We would like to receive four reprint copies of the Eighth Inventory of Metalworking Equipment (*AM*—Nov 17 '58).

If there is any charge. . .

John C McMurray
Waterbury, Conn

Dear Sirs:
. . . would appreciate receiving three reprints. . . .

Peter Flesch
Garden City South, NY

Dear Sirs:
Please place my order for two copies of the 1958 Inventory. . .

F T John
Los Angeles, Calif

Reprint copies of the Inventory are available from our Reader Service Dept at $2.00 per single copy or $1.50 each for quantities of 50 or more—Ed.

Dear Sirs:
It has been called to our attention that the Inventory issue of *American Machinist* shows that there are 27 ultrasonic cutting machines in the Southern California area.

We would like to have additional information on the names and locations of these 27 machines.

R E Ralsin
Los Angeles, Calif

We are very sorry, but we cannot reveal where these machines are located. The Inventory is conducted on a strictly confidential basis.

When we sent out our survey questionnaires, we promised to treat the returns from each plant confidentially. Because of this we can never disclose information on the machines in any one of these plants—Ed.

Tolerance booklet

Dear Sirs:
We would like to know if the articles by Walter H Harrington have been published in pamphlet form.

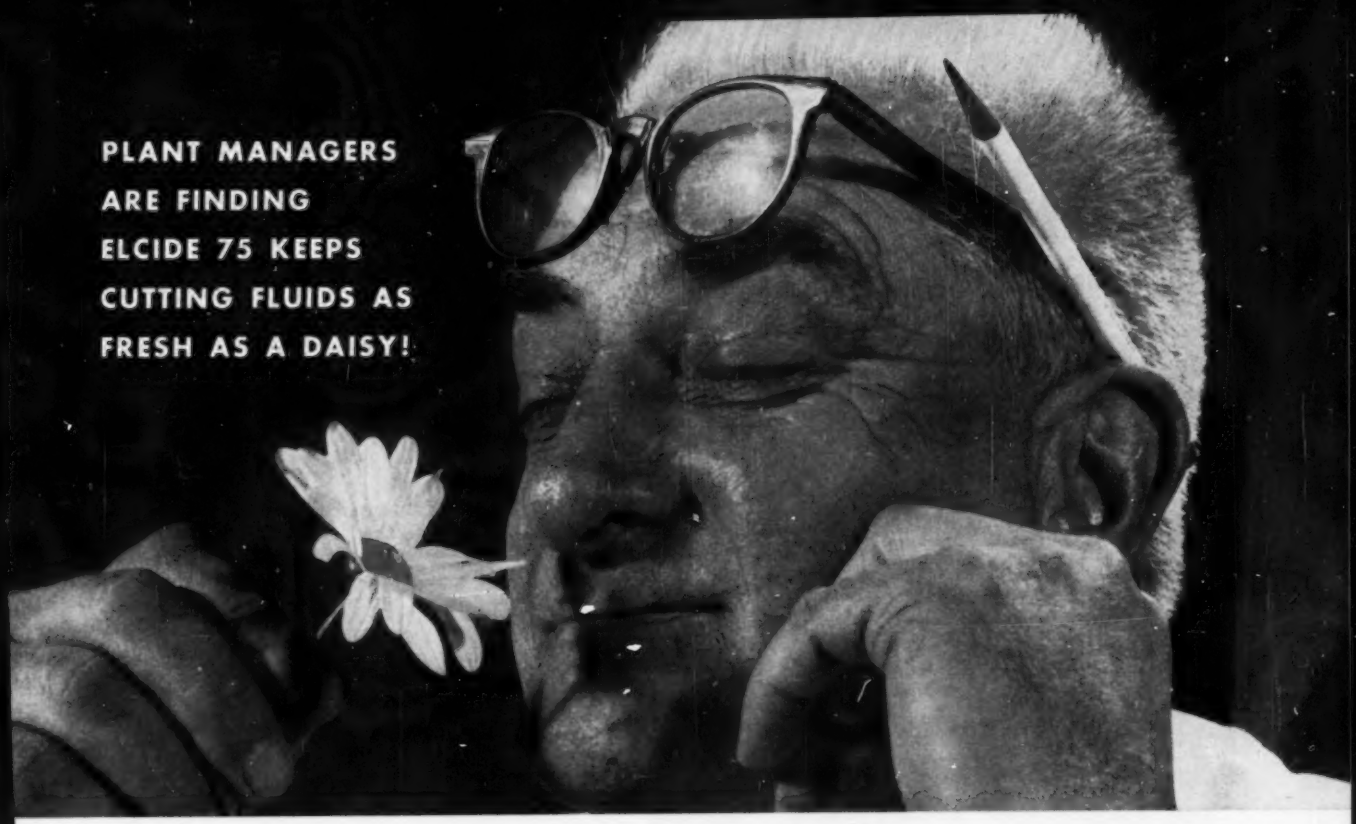
A seven-part article on "Geometric and Positional Toleranc-ing" appeared in your issues of June 16 through July 14.

Then an eighteen-part article on "True-Position Tolerancing"

SHOPMATES

N. Jarvis

WHAT'S HE DOIN' WITH ALL THE MIRRORS?? HE JUST RANSACKED THE WASH ROOMS.
--- SAYS HE CAN'T WORK BLIND --- GOTTA SEE WHAT'S GOIN' ON ---
--- BET HE CAN SEE THINGS THAT AIN'T HAPPENED YET!!
N. JARVIS



ELCIDE 75™ controls bacteria in soluble oil emulsions

...increases plant efficiency

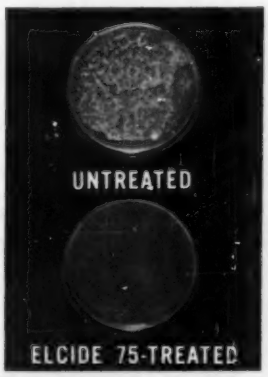
Elcide 75 extends the life of standard duty soluble oil emulsions. This longer emulsion life increases plant production and lowers operating costs.

Elcide 75 is a new bacterial inhibitor that controls a wider range of the harmful bacteria that cause emulsion breakdown, corrosion, and odor. This positive control means it is now possible to extend the life of standard duty emulsions up to 5½ times longer than ever before. This longer emulsion life decreases the down time previously spent for recharging, thereby increasing production and labor efficiency. Total soluble oil requirements are less, and waste-oil disposal becomes much less of a problem and expense.

Elcide 75 is safe to employees and machinery. Shop tests show it is nontoxic and safe, and it controls the bacteria that may cause acidic corrosion of machinery and staining of products.

Elcide 75 is more effective than commonly used single inhibitors because it is a combination of antibacterial agents, and includes a powerful new compound related to one of the safest and most effective bacterial inhibitors used in medical surgery today.

Bacterial plate counts prove the killing power of Elcide 75. The light areas shown in the photograph are harmful bacterial colonies that have built up in a normal untreated emulsion in 12 weeks. Notice the emulsion treated with Elcide 75 has been kept clean and clear.



Elcide 75 specifications: *Active Ingredients—Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium o-phenylphenate. Price per gallon—1 gallon polyethylene, $8.50, 5 gallon polyethylene, $8.00, 55 gallon stainless steel, $6.50. Sold only through selected distributors. For more information or to place your order, phone or write:*

ELCIDE 75™

Lilly

Lilly's brand of bacterial inhibitor for cutting fluids

ELI LILLY AND COMPANY, AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION, INDIANAPOLIS 6, INDIANA. TELEPHONE: MELROSE 6-2211

CIRCLE 189 READER SERVICE CARD

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MULTI-PURPOSE ALL-PNEUMATIC MARKING MACHINE

1 *Roll-Marking into Surface of Piston*
2 *Serial Numbering into Metal Shaft.*
3 *Permanent Marking and Graduating into Metal Collar*

Model 50P1

This multi-purpose Roll-O-Mark can be set up faster . . . tooled up easier . . . accommodates attachments more readily than any other marking machine. With all-pneumatic operation, no motor or separate power unit is required. Simply connect to the shop's air line—air is used *only* when in operation. This multi-purpose metal marking machine offers many other advantages such as—5" die slide stroke . . . open throat design . . . hand wheel for rapid table elevation . . . independent control for set up.

Whatever your needs for metal marking, Noblewest makes the machines, marking dies, and work-holding fixtures for doing the complete job faster, better, at lower cost. And remember, Noblewest Roll Marking is *permanently* indented marking—*good for the life of your product.*

Write for new catalog. The Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

A mark is only as good as the die that made it. Noblewest steel marking dies are precision made for permanently indented marking.

A few desirable territories open to qualified representatives

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

MARKING
NUMBERING
EMBOSSING
GRADUATING

appeared in the issues of Aug 11 through Nov 3.

We would like to purchase copies for our library.

Alice Crow
Engineering Library
The Martin Co
Orlando, Fla

Dear Sirs:
Our Product Control Division desires to use for training purposes 12 copies of the series of articles on "True-Position Tolerancing" which appeared in *American Machinist.*

Are reprints of these articles available? If so, would you advise us of the price so we can place them on order?

R E Dewhurst
Sandia Corp
Livermore, Calif

Dear Sirs:
We are interested in the latest information concerning geometric tolerancing. . . .

Frank J Renner
Joliet, Ill

Dear Sirs:
Will you please forward to the writer's attention, if available . . . "True-Position Tolerancing". . . .

R John Hess
Buffalo, NY

We are pleased to announce that the entire series on "Geometric and Positional Tolerancing" and "True-Position Tolerancing" has now been combined into a 28-page booklet.

The booklet is available through our Reader Service Dept at 50¢ per copy—Ed.

Helpful Henry

by L Hoppes

"No pressure sometimes! Let me fix it, oops!"

CALENDAR

Society of Automotive Engineers — Annual Meeting and Engineering Display, Jan 12-16, Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

Plant Maintenance & Engineering Conference, Jan 26-29, Public Auditorium, Cleveland, Ohio.

American Society of Mechanical Engineers — Aviation Conference, Mar 8-12, Statler-Hilton Hotel, Los Angeles, Calif.

American Society for Metals — Western Metal Exposition and Congress, Mar 16-20, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif.

American Machine Tool Distributors Association—Spring Meeting, Mar 17-19, Sheraton Park Hotel, Washington, DC.

Society of Automotive Engineers —National Production Meeting, Mar 19-20, Sheraton-Cadillac Hotel, Detroit, Mich.

Society of Automotive Engineers —Aeronautic Meeting, Production Forum, and Display, Mar 31-Apr 3, Hotel Commodore, New York, NY.

American Welding Society—Annual Convention and Meeting, Apr 6-10, Sherman Hotel and Donovan Hall, Chicago, Ill.

American Society of Mechanical Engineers—Metals Engineering Conference, Apr 29-May 3, Sheraton-Ten Eyck Hotel, Albany, NY.

American Foundrymen's Society —Engineered Castings Show, Apr 13-17, Sherman and Morrison Hotels, Chicago, Ill.

American Society of Tool Engineers—Annual Meeting, Apr 18-22, Schroeder Hotel, Milwaukee, Wis.

National Tool & Die Manufacturers Association—Spring Meeting, May 2-5, Statler Hotel, Washington, DC.

American Society of Mechanical Engineers — Production Engineering Conference, May 12-14, Statler-Hilton Hotel, Detroit, Mich.

NEW! *Two Cylindrical Die Type* THREAD ROLLING MACHINE

HORIZONTAL TYPE

Especially Suited for Job Shops

for Both In-feed and Thru-feed Rolling

The use of highly skilled setup and operating personnel is not required, because of the simplicity of operation and of changeover from one job to another. A cam-actuated head feeds the dies into the work and a fine micrometer adjustment provides for accurate final sizing. Can be used for manual, semi-automatic or completely automatic feeding.

Supplements widely used Reed cylindrical die thread rolling machines of the three die type.

DIAMETER CAPACITIES

In-feed - up to 2 inches

Thru-feed - up to ¾ inch

REED

Write for Machine Bulletin B 111-1

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

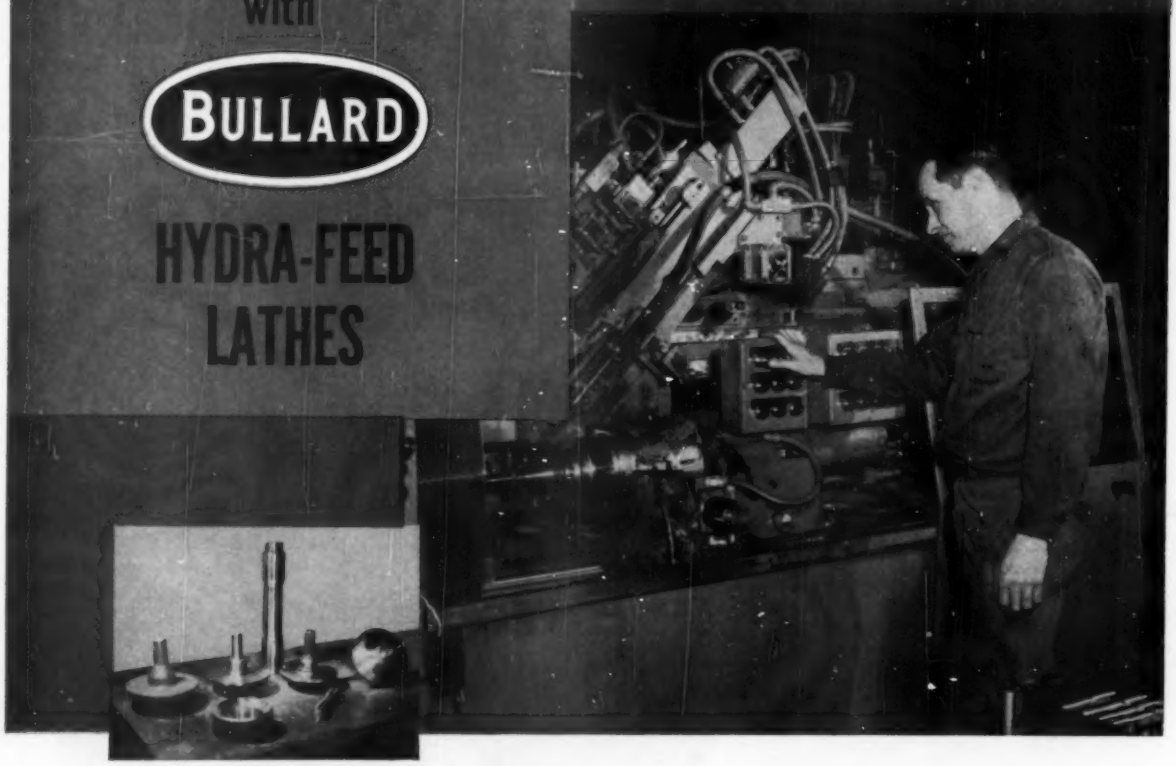
WORCESTER 1, MASSACHUSETTS, U.S.A.

Sales Offices In: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

THM-188

INCREASE PROFITS by REDUCING COSTS with BULLARD HYDRA-FEED LATHES

The experience of The National Supply Company, Toledo, Ohio, manufacturers of oil field machinery, as related by Mr. Owen U. Trumbull, Tool Engineer, can be applied to improve your profit picture.



Their BULLARD HYDRA-FEED TRACER LATHE . . .

- ★ Replaced four machines previously used
- ★ Reduced machining operations from ten to four
- ★ Held work to closer tolerances
- ★ Decreased spoilage
- ★ Simplified tooling and set-up

These are all factors that have a direct bearing on profits

The BULLARD COMPANY
Bridgeport 9, Connecticut

Remember . . . to cut costs when cutting metal . . . Buy BULLARD

SPOT NEWS...

- **Tape-controlled contour-machining equipment for making body dies** is being developed by a prominent automobile company. Big advantage will be savings of time in retooling when new shells and bodies are designed.
- **First break in Detroit tool and die shops' high wages dilemma** came late this month, when Garland Mfg Co wangled a one-year labor contract from a UAW-CIO Local for a wage *cut* of 19¢ an hour, bringing the average hourly rate down to $3.25. This could mean unions recognize that Detroit contract shops are losing jobs to outstate competitors and captive shops because of high wage rates.
- **Red China has already revised its "Catch up with Britain in 15 years"** industrial goal (*AM*—Sept 22 '58, p96). The new timetable: five years.
- **Electron-beam welding,** currently under wraps at Airco, works this way according to J H Humberstone, president Air Reduction Sales Co: It's a high-vacuum process (10^{-5} mm Hg) in which a beam of electrons from a heated tungsten filament is focused magnetically into a small spot. There is no arc, but the work passes through the spot, is welded. Power required is about 15,000 volts, 70 milliamps, for ⅛-in. stainless. High vacuum practically eliminates contamination.
- **Survey of members recently conducted by the Pressed Metal Institute** shows that 20% of reporting companies added an average of 20,000 sq ft of floor space in 1958, 37% bought presses of below 100 tons capacity (an average of two presses per company), 15% bought presses of more than 100 tons (also two per company); 47% bought such supplemental equipment as lathes, grinders, shapers, drills and fork trucks—5% plan to add to existing plants in 1959.
- **China has ordered $4.2 million worth of precision steel tubes** from Tube Investments Ltd of London.
- **A giant rocket engine capable of putting up manned satellites** will be designed and developed by Rocketdyne Division of North American Aviation under contract to the National Aeronautics and Space Administration. Object: to produce an engine with up to 1.5-million-pounds thrust.
- **Taxing of Boeing workers for state-to-state moving and travel expenses** is being challenged by three Boeing engineers in Seattle District Court. Government taxed the engineers, instead of Boeing, which paid the moving bills. The workers contend that this is not income for them, rather a convenience for Boeing, which should pay the taxes.
- **Russia now has a 30,000-metric-ton press** that weighs only 550 metric tons, one-fourth the customary weight ratio of such presses. Upright press columns are replaced by a concrete cylinder. Press takes up only a fourth as much space as conventional heavy presses.
- **Foreign car imports continue to rise,** despite prospective early entry of Big Three U S small cars into competition with them. In 1959, it is expected that 425,000 to 450,000 foreign cars will be sold here, compared with 375,000 this year. Big Three-sponsored imports, however, are cutting into Volkswagen and other imported car leaders.
- **Britain will replace the Canberra twin-jet bomber** with a new supersonic strike-reconnaissance plane "capable of operating from very small fields."
- **East Germany has successfully flown its 152 jet transport prototype,** the first jet plane to be designed and made in Germany since WW II.

Spot index to major News stories...

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GAGES FOR MISSILE HARDWARE

Manufacture of missile hardware is admittedly exacting. A good healthy respect for dimensional precision is imperative for reliable missiles. Likewise the specialized equipment to assure the necessary high order of dimensional control.

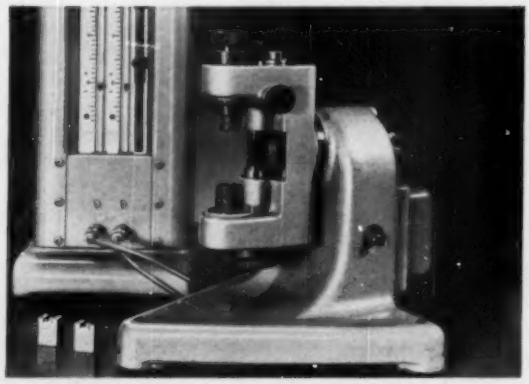
From the outset of the missile era, Sheffield has led the gage development work in this field. Close liaison is constantly maintained with missilemen of the Armed Services. Recourse to the facilities of the Eli Whitney Metrological Laboratory and consultation with its professional staff are always immediately available.

As a result, Sheffields' contributions have materially aided in the dimensional control of many missile components such as:

- **Nose cone assembly**
- **Elements of guidance systems**
- **Units of the propulsion system**

Precisionaire Gage for accurately determining the thickness deviation of a nose cone at 128 points around its periphery from base to apex.

This assembly of Sheffield instruments automatically delivers a printed record of single or multiple dimensions. It also computes and records the difference in related dimensions.



Combination inspection gage and assembly fixture with 2-column Precisionaire instrument permits precise adjustment of end shake in gyro assemblies.

For specific information on your particular problem write to **The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 1.**

the **SHEFFIELD** *corporation*

of Bendix Aviation

manufacture and measurement for mankind

Sheffield gages are used to check relationship of gimbal axes for angle and intersection of planes.

8147

WASHINGTON...

Scrap seeks relief . . .

Institute of Scrap Iron & Steel has taken its industry's sagging market symptoms to government trade analysts for an official diagnosis and prescription for federal aid.

The trade association met first with OCDM, cited bearish statistics which show that independent ferrous scrap producers' sales are running a third below previous annual totals this year.

What scrap people want OCDM to do is find scrap defense essential. This would spur sales to domestic steel mills, which scrap industry spokesmen charge are deliberately seeking ways to speed steel production's increasing independence from scrap.

Such a finding could also be the basis for curbing competing imports of raw iron ore, which steel mills are using in place of scrap. Domestic iron mines are joining in this drive.

Weeding the fringes . . .

The weeding out of what Defense Secretary McElroy calls "marginal" missile projects is going on with a vengeance in the Defense Dept. Latest casualty: Fairchild's Bull Goose decoy missile, under development for the Air Force. An earlier missile cancellation was Bell's Rascal air-to-surface missile, in early production for the Air Force.

Betting at the Pentagon is that the Navy's Regulus II, a supersonic 1000-mile, surface-to-surface missile with GM-AC's inertial guidance system, will be the next casualty. Chance-Vought is prime contractor, has been set to start quantity production.

For just about all the missile project cancellations, the Pentagon officially lists "changes in operational concepts" as the reason. This fools no one, however.

It's an open secret that budget restrictions are forcing the military services to make drastic changes in production plans. Overall programs for procurement of planes, missiles, and other hard goods have already been set in the new budget, reflecting the administration's military spending ceilings.

Now the Services are rejuggling production schedules to live under the expenditure limitations. For Regulus II, the budget-cutters make this argument: The missile is basically a stopgap weapon system until the Polaris IRBM goes operational. The bulk of Navy missile money is being poured into the Polaris project. Meantime, the subs specially designed to handle Regulus II are capable of taking on Regulus I, Chance-Voughts' earlier subsonic missile, which has a shorter range and radio command guidance. The latter missile has been in production for at least two years, and a substantial missile stockpile has already been built up.

Space projects booming . . .

For metalworking firms with missile contracts, cancellation of missile projects may be offset by the burgeoning Space Program, which consumes similar or related hardware. The program is being financed by both the Defense Dept (for military-type projects—mainly the Air Force's under supervision of the Advanced Research Projects Agency), and the National Aeronautics & Space Administration for purely scientific space experiments.

Over the next year, close to $500 million will be spent by both the military and NASA. By 1963, the program is expected to increase two or three times.

Right now, NASA is dependent on the military for buying much of the hardware already designed for launching military space vehicles.

In the near future, though, NASA will be turning more and more directly to contractors for advanced space gadgetry. But by that time, the Pentagon's own military space projects—reconnaissance and warning satellites, rocket ships, and the like—will be coming into the hardware stage.

Rundown on projects . . .

Here's a rundown on space launching for the new year:

- Air Force will fire at least 12 Project Discoverer satellites, weighing from 1300 to 10,000 lbs.
- Army will launch Pioneer IV, the final lunar probe shot in the US five-shot series for the International Geophysical Year. NASA directs the project. A souped-up Jupiter IRBM is the basic launcher.
- NASA will fire four remaining Vanguard earth satellites designed by Navy for IGY.
- Air Force will try to fly North American Aviation's X-15 manned rocket ship. Vehicle will be carried aloft in a B-52, then will try to soar to an altitude of some 120 miles at over 3000 mph. The experimental craft is considered a forerunner of interplanetary vehicles.
- NASA will fire as many as eight Army-designed Juno II rocket vehicles to orbit earth satellites, and for general scientific probes into the outer reaches of interplanetary space.

◄ CIRCLE 193 READER SERVICE CARD

JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it

Turret Lathe Tracing Pays off Double — and More!

It is hard to select the "best" feature of a J & L turret lathe which is equipped with a tracing unit. It could be the cost saving factor, as in the job illustrated above. Stainless steel forgings are first rough-machined with tools from the hexagon and square turret positions. Then, *in the same chucking*, the tracer is engaged and the parts are contoured to a 16 mu-in. finish at better than 1000 SFM. Manufacturing costs were cut 74%.

Another customer points out broader advantages. He says: "My turret lathe with its tracing attachment is the most versatile machine in my shop. It's a bar machine, a chucker, an engine lathe, and a shaft and cross-center duplicator, combined. No machine could do more, or produce more profits for me."

Write for detailed information. Jones & Lamson Machine Company, 502 Clinton St., Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Precision Boring Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

DETROIT...

Most autos boom . . .

Nine-hour days and six-day weeks are standard everywhere but Chrysler as makers swing into first quarter schedules that call for nearly 1.7-million passenger car assemblies. Cars are being well-received by customers, and in some cases healthy backlogs exist.

Studebaker, for example, has already taken dealer orders for about 55,000 new Larks. This is more cars than were produced during the entire 1958 model run. As of December 29 the company instituted a work schedule calling for 70 units an hour, to wipe out the discrepancy between orders and retail deliveries. The latter, though, are at their highest rate since June 1955.

American Motors, booming along at a maximum effort pace, announced a $10-million expansion program to boost annual capacity 33% to 440,-000 units. The money will be spent to augment production tooling, rather than on bricks and mortar. All machinery should be in place in time for the 1960 model changeover. Welding equipment manufacturers and machine tool builders will get the bulk of the bonanza.

Ford is currently pacing its 1957 model schedules, which were record breaking for that division. Chevrolet, too, fractured an all-time industry record by producing 45,303 cars in the second week of December. During the same week, Cadillac turned out 4413 for the highest total in its 57-year history.

Buick recently polled dealers in the nine biggest metropolitan centers and found average retail deliveries up a whopping 140% over last year. Oldsmobile and Pontiac are also working overtime to keep up with orders.

Yet no picture can be complete without Chrysler. This company has been limping from one strike to another ever since new models were introduced. From September through November there have been 247 unauthorized walkouts, costing a total of 2,416,579 lost manhours. Currently it is still 80% crippled by the walkout at Dodge—now entering its third week.

Though there may be an interim and token settlement by Christmas, look for more trouble next month. Reason: UAW-CIO Local 3 is fighting a lonely rearguard action, trying to maintain jobs that no longer exist in a modern auto plant.

Diesels for everybody . . .

GM's Detroit Diesel Division has long produced unique, two-cycle engines in six basic configurations ranging in maximum horsepower from 67 to 335. These units, affectionately nicknamed "Jimmies" by allied soldiers in World War II, were and are world-famous for reliability. However, the line as a whole had one major fault.

This was that despite over 1800 known and different applications, the horsepower range available was too narrow to really tap the fast-growing market for diesel power. Though diesel makers publicize no figures, U S production is estimated to have jumped from 100,000 units in 1952 to 170,000 in 1957, and it is still climbing.

The company's solution was to take its basic design, called the "71" series, and multiply cylinders to catch high-horsepower users, meanwhile filling in the low end of the scale with a 53-cu-in.-per-cylinder version of the same design. The new range starts with the 2-cylinder, 20-hp "53" and goes on up to a massive V-32 cylinder turbocharged "71" that puts out a potent 1650 hp, enough to run most locomotives. By the end of 1959, any of these engines can be had with an optional aluminum block.

Within each of the two series, practically every part is interchangeable, except for the block and crankshaft. Common parts permit Detroit Diesel to charge up to 50% less for replacements than competition. Even between the two series some key items, such as basic fuel injection parts, are interchangeable.

The program, started in 1955, required 1,250,000 engineering and 80,000 engine test hours. Prototype vehicle applications have already been driven 500,000 test miles and designers have generated 14 million square feet of blueprints. This latter does not include 60 miles of 3-ft-wide paper, used up by manufacturing for plant layout. In all, 1875 machines were moved or purchased to set up the new production lines, requiring a 300,000-sq-ft plant addition.

Oops! Wrong Fisher . . .

On the Spot News page of our December 1 issue, *AM* carried an item to the effect that "Reinforced plastic motor boats that look like Chevrolets on water are reportedly being readied by Chevrolet and Fisher Body."

In essence the item is true—except for one thing—Chevrolet and Fisher Body have nothing to do with it.

Seems that a man named Fisher (no connection with GM) *is* readying such a line and hopes to market the boats through Chevrolet dealers, who may sell anything they wish as long as it doesn't compete with the Chevy. But Chevrolet disavows all connection with the idea.

DRILLS or TAPS

6 *different diameters in* 22 *SECONDS!*

The new BURGMASTER

Bench Model Turret Drill

- Power indexes between stations
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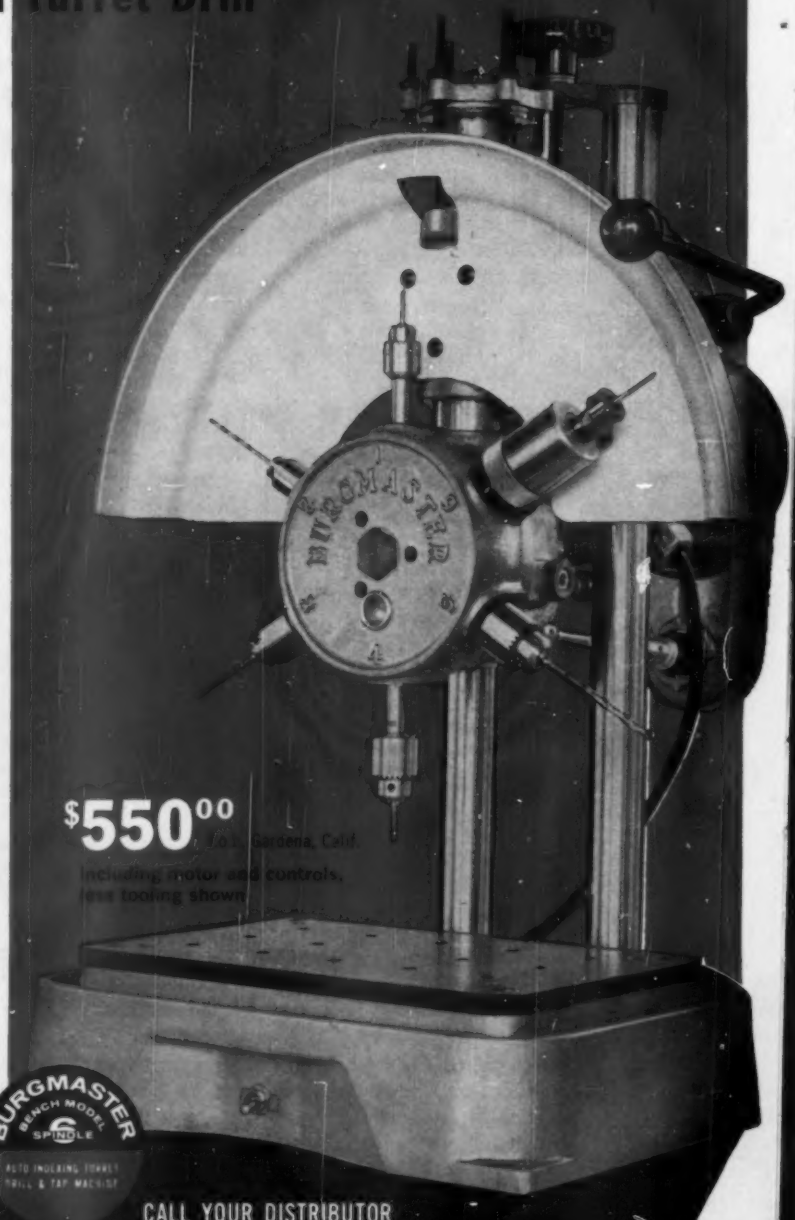
- 2 complete speed ranges
- ¼" maximum capacity
- Protective overload slip clutches on spindle drive and indexing mechanisms



Here's the newest, most efficient drill press available for making small holes, faster! A Burgmaster *finishes* the job in the time normally required *to move work from spindle to spindle*—without machining! No lost motion, no operator fatigue...the powerful Burgmaster Bench Model drills up to ¼" diameters in steel; taps, counterbores, countersinks, reams, spot-faces!

INSTANTLY INDEXES ITSELF to each new station for a change of hole diameter or tooling. Duplicate operations can be performed with any spindle *without indexing.*

INDIVIDUAL SPINDLE SPEEDS—Each spindle *has its own speed* for greatest drilling efficiency with different tool sizes and without changing belts, gears, etc. Two spindle speed ranges cover 95% of all machining requirements with tools up to ¼" in diameter. Spindles can be located in any station sequence for maximum production efficiency.

For greater output, for lower cost per hole get the new BURGMASTER Bench Model!

SPECIFICATIONS: Maximum capacity, ¼" in steel; overall dimensions, height 31½"; width, 17"; depth 20"; motor, ¼ hp; chuck to base clearance, 10¼"; maximum spindle travel, 2⅞"; center of spindle to column clearance, 5⅜"; geared head permits each spindle to operate at a predetermined speed between 350-6200 rpm.

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AIRCRAFT and MISSILES...

TRENDS

The big question mark...

The aircraft industry is pretty well agreed that production will hold to present levels through 1959, IF there is no drastic, unforeseen cut or increase in defense spending.

Los Angeles area aircraft and missile employment, for example, at year's end stood at 186,000, compared with 209,000 at the end of 1957, but up somewhat from 1958's late-summer low point.

Consensus is that area aircraft and missile employment will stay around 186,000 in first half '59. The current Los Angeles area weekly payroll of $23.25 million for major primes isn't expected to dip in 1959, even if employment totals were to drop. Reason for this is that even though the shift to missiles in the coming year might call for fewer workers, the ones retained would be the cream of the industry and would consequently command higher wages.

Latest available figures show that area primes have a total backlog of $3.54 billion, broken down this way: military aircraft and related items—$1.72 billion, commercial—$1.18 billion, missiles and related items—$0.64 billion.

Should business for aircraft primes continue at present levels—and little in the way of spectacular new contracts is in the offing to date—the amount of work that is let out to subcontractors can be expected to drop, despite government efforts to spread such work around. You can even expect primes to step up activity in doing subcontracting work for each other.

In the words of one major aircraft manufacturer, "If there isn't too much work to pass around, we'll have to do what we can to keep our own workforce busy."

Those primes who do expect to maintain present ratios of subcontract work admit that such work has already been slashed drastically from year-ago levels. In 1957, Lockheed, for example spent $225 million in Los Angeles County alone for subcontracting jobs and outside purchases. In 1958, Lockheed spent only $120 million.

Subcontracting outlook dim...

With emphasis continuing to shift to missiles, there's less and less for the subcontractor to be hopeful about. Missiles by their very nature require less hardware than manned aircraft. On top of that, fast-advancing technology seems to preclude the government from placing large production orders for missiles.

At three years of age, a missile is old. With new developments coming along constantly, the government prefers to dole out funds slowly so as not to be stuck with a huge quantity of missiles that are either totally obsolete, or require expensive modification.

Heavy presses for missiles?

The Air Force has just kicked off a full-blown promotional campaign. Object: to sell missile producers on using its 16 heavy extrusion and forging presses for making missile components.

Behind the drive is the Air Force's concern over the declining rate of aircraft work for the heavy presses—plus a belief that the mammoth machines can be used efficiently and economically in burgeoning missile programs.

But the first job is to educate missile design engineers in heavy press capabilities. For that reason, the Air Force recently held a meeting at Wyman-Gordon Co's North Grafton, Mass, plant, which houses one of the heavy presses. Attendees included 200 military production experts, and design engineers from missile and rocket firms.

The missile men's reaction to the heavy press sell is reportedly "excellent," according to the Air Force. And they think the "adaptability and advantages" of the heavy presses could well pay off as missile production volume grows.

Right now, the heavy presses are being worked at an average of only 30% of capacity, all except one—Alcoa's 14,000-ton extrusion press at Lafayette, Ind—which is running in three shifts to produce wing spars, bulkheads and landing gear for the B-52 bomber and KC-135 jet tanker.

Some civilian work—notably components for Douglas's DC-8 and Boeing's 707 jet transport—is being done on heavy presses, but it's just not enough to fill the gap caused by the switchover from military manned aircraft to missiles.

About 5% of total heavy press capacity is already devoted to missile work. Example: Wyman-Gordon produces nose cones for ballistic missiles.

New missile target team...

Aeronca Mfg Corp, Middletown, Ohio; Emerson Electric Mfg Co, St Louis; and Experiment Inc, Richmond, Va, have teamed up to complete development of a missile training target system—when and if they get an Army contract.

Under the plan, Aeronca would be responsible for the airframe and for overall systems integration; Emerson for electronics component systems; and Experiment Inc for the power plant.

◄ CIRCLE 195 READER SERVICE CARD

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ELMIRA, N.Y.

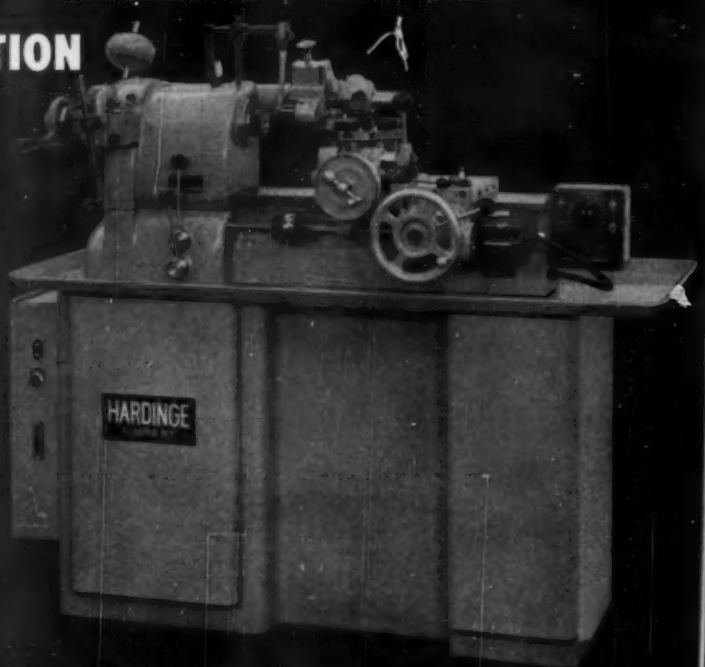
HARDINGE EASY READING BLACK and WHITE DIALS

mean INCREASED PRODUCTION

. . . **HARDINGE** developed these fast setting, easy reading **black and white dials** – they assure maximum accuracy with high production.

Pioneered with the Hardinge High Speed Precision Chucking Machine model HCT shown here – **Hardinge black and white dials** are now standard equipment at **no extra cost** on all of our tool room and production machines.

Invest in Hardinge equipment for product improvement and increased production. Ask for bulletin on our tool room and production machines.



HARDINGE BROTHERS, INC.
ELMIRA, N. Y.

MACHINE TOOLS...

Chrysler has tooling program . . .

Chrysler's tooling program for a new transmission for all its cars is the biggest pending piece of machine tool business at Detroit.

It may run as high as $30 million and probably will not be placed with builders until late spring.

The small Chrysler six meanwhile is getting lots of attention. Chrysler has not yet decided how much rebuilding of existing machines will be done in tooling up for this job. If it can keep the cost down to around 65% of what new machines will cost, there is likely to be a lot of it.

Total machine tool orders for the Chrysler six are estimated at a low of $7 million and a high of $15 million.

Basic design of the new Chrysler engine is said to be suitable for a new Plymouth six engine and possibly Dodge too. Chrysler is reported considering both cast iron and aluminum engines, the latter perhaps embodying a die-cast aluminum block.

Chrysler incidentally is in the process of consolidating all its engine manufacturing facilities at two spots—the Plymouth plant in Detroit and the Trenton, Mich, plant. Engines formerly were made in four plants.

Deliveries of new and rebuilt machine tools for the small General Motors car are about to begin, with the engine line being set up at Chevrolet's Tonawanda, N Y, plant. Timing points to possibility of a late spring announcement of the new car. This would preclude the fear that the small car might steal the show from standard-size lines at normal introduction time next fall.

Total machine tool purchases for this rear-engine six are said to be within the $10- to $15 million range. This total would include rebuilt as well as new machines.

Caterpillar placing orders . . .

Caterpillar Tractor is in the midst of a sizeable retooling program for its tractor engines. Some business already has been placed, including orders for foreign machines. Caterpillar's management is reported as feeling that, since a considerable percentage of its sales are made abroad, it is justified in securing some of its machine tool needs from European builders.

Fellows to build Pfauter line . . .

Fellows Gear Shaper Co, Springfield, Vt, will make and market the entire line of gear hobbing machines and worm milling machines of Hermann Pfauter, Hobbing Machine Works, Ludwigsburg, Germany.

SIGNING THE FELLOWS-PFAUTER AGREEMENT at Springfield, Vt, this month were, from left: Dr Michael Pfauter, managing director of Hermann Pfauter; President E W Miller of Fellows; Friedrich Becher, chief engineer of Pfauter; E R Fellows II, vice president and general manager of Fellows; and John Morton, patent attorney, Fellows Gear Shaper Co

Building of Pfauter hobbing machines will begin at once at Springfield. Until production facilities are set up, Fellows will act as sales agent for the remainder of the Pfauter line.

Fellows-Pfauter gear hobbing machines will conform to American standards and will be serviced by Fellows' nation-wide organization. Pfauter line ranges from the smallest machine with a maximum capacity of 3-in. pitch diameter, 2¾-in. face width, to one producing a gear of 120-in. pitch diameter, 1¼ pitch and 30-in. face width. Diagonal hobbing is the latest Pfauter development.

Fellows, in addition to its own gear shaping and gaging machines, makes and markets plastic injection molding machines, is manufacturing 6 million twist drills a year, is developing and testing the Appel cold forming process machines for kneading or plasticizing materials at very low temperatures, and is building Reishauer gear grinding machines which have been redesigned to American standards.

Greenlee to diversify . . .

Greenlee Bros & Co, Rockford, Ill, has bought the Buss Machine Works and its subsidiary, B & T Machinery Co, both of Holland, Mich. B & T Machinery Co builds die casting machines which will be added to Greenlee's line of standard and special machine tools. Buss Machine Works makes woodworking machinery—planers, surfacers and special machines. Sales departments of Greenlee and of B & T Machinery will be combined to achieve the best results in the die casting machinery field. Manufacture will continue at Holland.

BF

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Liquid Nitriding — particularly effective for tapping cast iron, stainless steel, plastics, as well as any abrasive material.

Flash chrome plating — recommended for tapping copper, zinc base die castings and cold forming steels.

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MATERIALS... TRENDS

All that glitters . . .

An automobile hubcap that sparkles is being made of fiberglass, with a layer of gold and silver glitter just below the outside transparent surface coating. Colorado Fiberglass Co (Denver) is stepping up present production of 100 hubcaps a day to meet rapidly growing demand; turns out 14-in. and 15-in. dia hubcap replacements said to fit 90% of autos now on the highways. Models for foreign, sports, and "economy" cars (13-in. dia) are forthcoming. Company spokesman says advance indications are that it may have the hula hoop of the automobile world. (Insurance companies should be happy at the lower cost, but this idea could ruin the not-so-funny market for stolen hubcaps!)

An aluminum letter (paper backed) in an aluminum envelope was the method used by Chase Brass & Copper Co, Waterbury, Conn to announce that certain of its warehouses now stock Kaiser Aluminum mill products. Letters are being used for localized mailings to customers in each of the areas served by the company's 25 warehouses.

Aluminum products market . . .

Building products of wrought aluminum lead all other end-use classifications for this material, as they have since the latter half of 1954, during the first half of this year. Shipments to the building and construction field accounted for 22.5% of all wrought aluminum products shipped, up 0.2% from shipments reported in last half of 1957.

Shipments of aluminum permanent-mold castings showed no change in the order of volume since the second half of 1955, according to Donald M White, executive secretary of The Aluminum association. Non-military motor vehicles remained the leading user, accounting for 57.9% of reported shipments.

Largest share of aluminum sand castings (42.8%) was used in industrial and commercial machines, equipment and tools.

Cast car-door hinges . . .

More than one million automotive front-door hinges per month are being cast of malleable iron at the Defiance, Ohio plant of General Motors' Central Foundry Division. Used on all 1959 GM cars, the cast hinges have replaced hinges formerly made of rolled steel sections.

Conversion of the hinges to malleable-iron castings has eliminated shearing and forming operations and has simplified machining. Stress analysis in design has enabled the foundry to produce lighter and better looking cast hinges than the former rolled-steel hinges.

Light-metal engines and corrosion . . .

Use of more light metals in automotive engines and cooling systems will pose new antifreeze corrosion problems, L C Rowe of General Motors Research Laboratories Chemistry Dept told the Chemical Specialties Manufacturers Assn.

"Regardless of how extensively aluminum is used, it will result in corrosion problems which are slightly different in nature than those previously experienced. Pitting and galvanic corrosion are sure to be more prominent," he warned.

Suggested research programs, some already underway by GM, included: Effects of water quality in various parts of the country on corrosion and inhibition. Effect of heat transfer, surface boiling, and hot spots on metal corrosion. Effectiveness of corrosion inhibitors in crevices and low-velocity coolant areas. Effect on corrosion of service variables such as poor maintenance, anti-freeze re-use, and driver habits.

Answers to these problems should prove useful in the selection and application of cutting fluids, coolants, and lubricants in industrial machinery and machine tools which are also showing increasing use of light metals.

• **Two new plating systems, for zinc die castings,** investigated during a recent research program sponsored by the American Zinc Institute appear to be particularly useful for corrosion prevention. They are being used to plate automotive hardware. W H Safranek, a specialist in electroplating, described the research being conducted for the AZI at Battelle Memorial Institute (Columbus, Ohio).

A composite copper-nickel-chromium system, described first, deposits a crack-and pore-free chromium, as thin as 0.000025 in., over the customary thickness of copper and nickel to provide "excellent" protection against corrosion.

Second to be described was the duplex-nickel system in which two layers of nickel are electrodeposited in different baths. Conditions for plating the first, thicker layer are adjusted to deposit nickel that is relatively passive to corrosive environments. Then the outer layer is plated as bright nickel that requires no buffing. The latter form of nickel is more active chemically than dull or semi-bright nickel plate. Duplex plating furnisher much more corrosion protection than an equal thickness of a single bright-nickel layer.

★ ★ ★ ★

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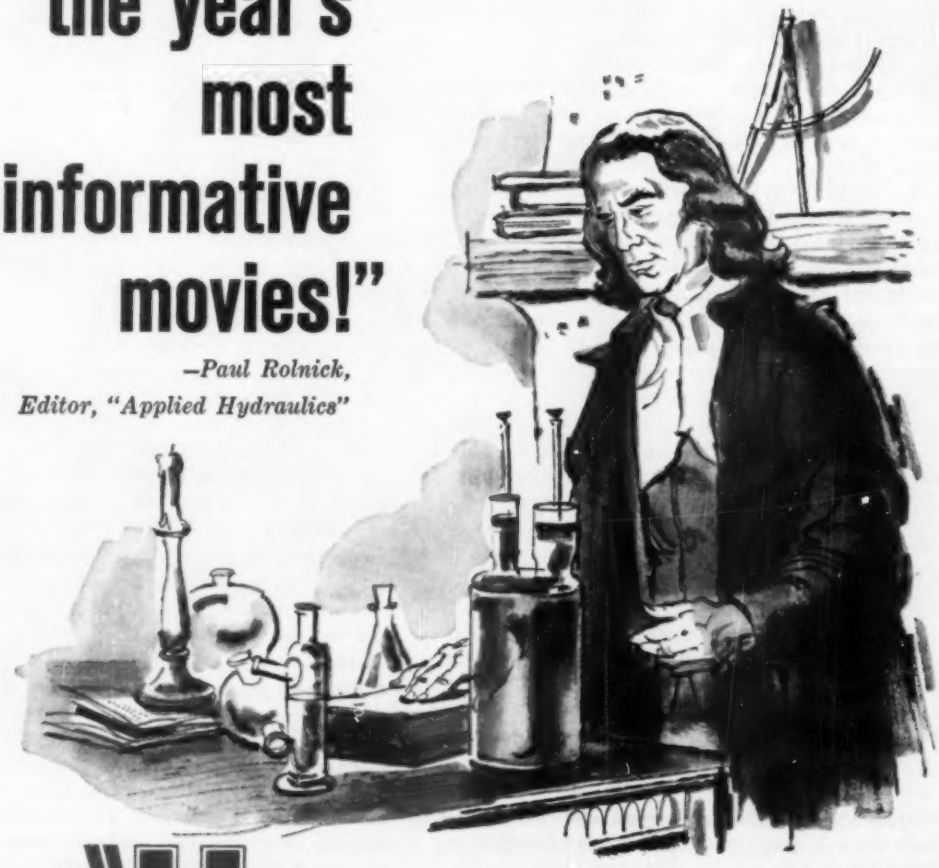
–Paul Rolnick,
Editor, "Applied Hydraulics"



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TEXACO

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

WHAT'S AHEAD... in Metalworking

TRENDS

The outlook is fine for '59...

A wave of optimism over prospects for 1959 is sweeping over the metalworking industry, even though at 1958's end the fast recovery from recession lows seemed to have slowed somewhat. Here is how various segments of metalworking view the coming year:

• **Basic steel** as 1958 drew to a close chalked up its highest output of the year—75.5% of rated capacity—and total 1958 production ran somewhere in the neighborhood of 85 million tons.

For 1959, the steel people firmly believe they will better this figure by as much as 30%.

Look for the 1959 steel picture to shape up this way: a strong first half, a prolonged strike shutdown in the third quarter, then a strong fourth quarter to make up for lost time.

• **Steel warehousers** see a 10% to 15% improvement in sales next year, but this will still leave them considerably below 1957 levels on a tonnage basis.

• **Appliance makers** see no reason why the strong upward sales and production trend started in second half 1958 shouldn't carry through '59.

Outlook for the industry as a whole is a 5% to 8% increase—for a total output of 15 million major appliances of all kinds.

Automatic washer sales are expected to increase by 400,000 units, refrigerators by 100,000 units, and clothes dryers by 100,000 units. Home freezers will just about hold their own, while ranges and wringer washers may decrease slightly.

Automatic dishwasher sales should climb 13%. TV set sales should jump from this year's 5 million to somewhere between 6 and 6.3 million. Stereo equipment sales will continue to zoom, and radio sets will do well, too.

• **Railroad car and equipment manufacturers** don't see any big upsurge in 1959. Rather, they expect a very gradual improvement.

• **Construction machinery makers** are pinning their hopes on an expected 10 to 15% increase in highway construction outlays slated for 1959.

• **Mining equipment sales should increase** in '59, now that open pit mining is doing better.

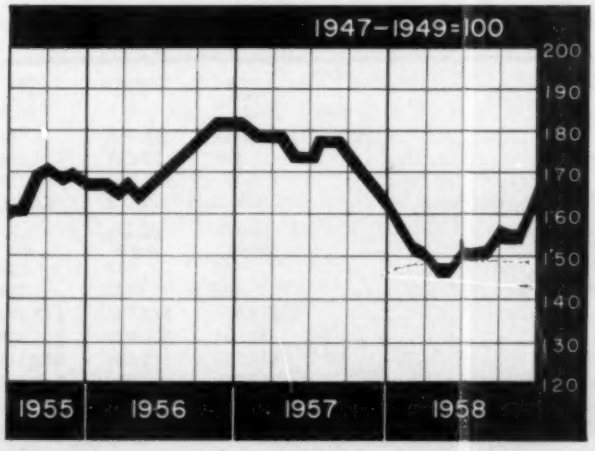
• **Heat treaters** feel their business won't pick up much until the machine tool and capital goods fields get back on their feet.

• **Foundry outlook is uncertain for 1959.** Nonferrous founders, down to rock-bottom backlogs, expect that any improvement will be slow. Steel foundries, on the other hand, look for a 1.5-million-ton output in 1959, compared with 1958's 1.2-million tons. Gray iron foundries hit their highest operating rate of 1958 in October (68.3% of capacity), have held fairly close to those levels since, and expect to do about 20% better.

• **Stampers,** while not overly optimistic about 1959, according to the Pressed Metal Institute, aren't pessimistic either. It seems 30% of PMI members expect to do 15% better business in first quarter '59. Other 70% see no change.

• **Tool and die industry,** running about 25% behind comparable 1957 at year's end, expects a mild increase of maybe 15% this coming year, with appliance and electronics orders strong but automotive orders weak.

• **For 1959 predictions in the automotive and aircraft and missile industries, see pages 29 and 31, respectively.**



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

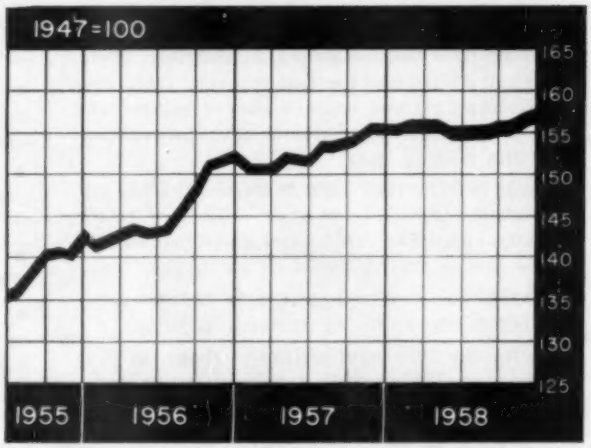
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	DEC Estimated	NOV Preliminary	OCT Revised	NOV Year Ago
Total Index	**165**	**163**	**155**	**157**
Machinery		131	130	142
Electrical Machinery		189	177	199
Autos		148	92	149
Other Transportation		305	340	292
Other Metalworking		140	140	145

TRENDS WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	DEC Estimated	NOV Preliminary	OCT Revised	NOV Year Ago
Total Index	**157.7**	**157.5**	**156.3**	**155.9**
Metalworking Machinery	**181.2**	**181.6**	**183.0**	
Other Machinery exc. Electrical	**167.8**	**166.5**	**166.1**	
Electrical Machinery	**158.8**	**158.8**	**157.0**	
Fabricated Metal Products	**148.3**	**146.7**	**146.5**	



It'll be durables' turn to rise in '59...

Nondurable goods output held up a lot better in the recession than did durable goods production.

Next year the big growth will be in durables, not in soft goods. Here, however, is a brief report on the various output trends of nondurable goods industries next year.

Chemicals, after hardly feeling the impact of the recession, are expected to register a gain of 10% in output in 1959. New records are expected for plastics, pharmaceuticals syntheic fibers and some heavy chemicals.

The paper and pulp industry proved to be one of the most recession-proof industries during the last year, leading the economy out of recession.

This trend is expected to carry into 1959. Physical volume of production of paper and pulp is expected to be up about 7%.

Rubber production declined by 8% in 1958, but the replacement market for tires held up so that the impact of a 25% drop in new car production (and in original tires) was not felt in full force.

An 11% gain in physical volume is anticipated for the year ahead, with auto production expected to recover to at least a 5.5-million car year.

Total demand for petroleum in 1959 is expected to show its first significant gain since 1956.

Petroleum demand and production should be up more than 4% in 1959, compared with an increase of only 1% during 1958.

The processed food and beverage industry will probably register a gain of about 5% in 1959.

Output of textile mill products led the general recovery by one month, turning up in April prior to the general business turnaround. During 1959, overall textile demand should be up about 8%, with apparel and home furnishings registering gains of 5% to 10%. The auto industry, the biggest industrial consumer of textiles, will also up its take substantially in 1959.

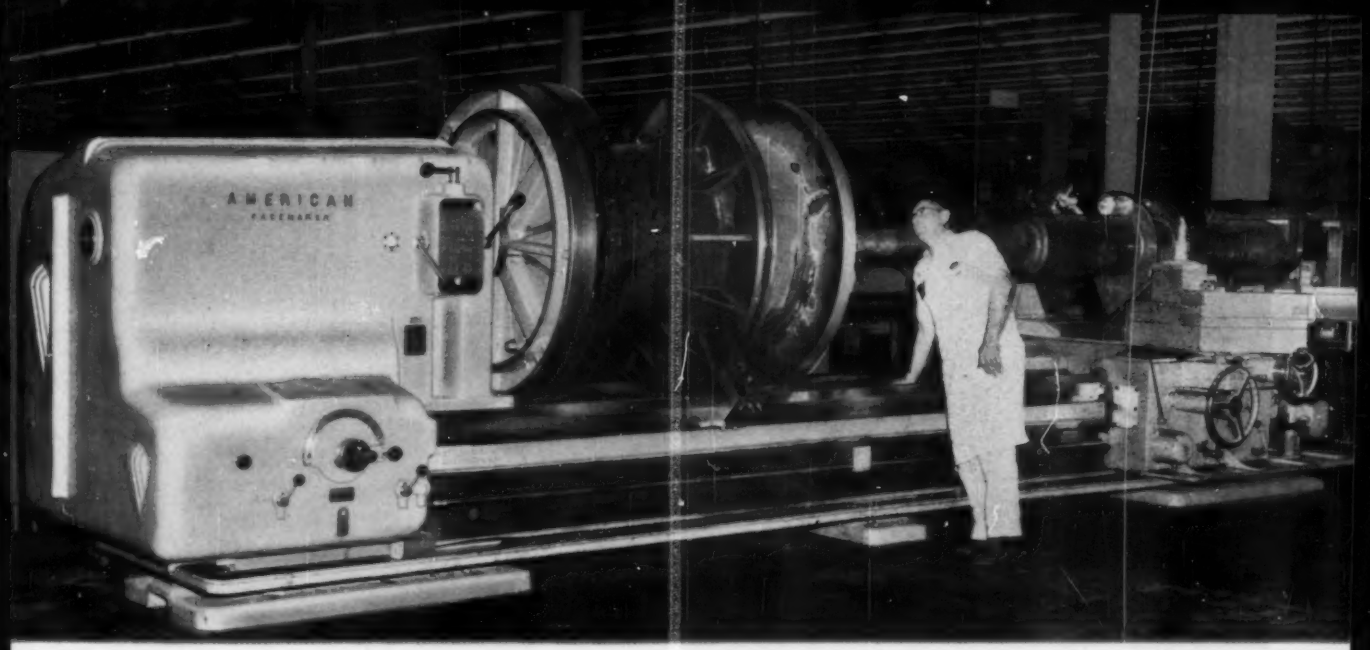
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	141.7	140.6	138.0
Steel ingot operation (thousands of tons)	2,036	1,985	1,742
Electric power output (million Kilowatt hours)	13,450	12,017	12,570
Production of automobiles and trucks	172,021	179,872	175,252
Engineering construction awards (Eng. News-Record—millions)	$291.8	$353.3	$265.6

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	141	138	139
Index of durable manufactures production (1947-1949=100)*	152	145	154
Durable goods manufacturers sales, millions*	$13,013	$12,723	$13,932
Machinery manufacturers' sales, millions*	$3,981	$ 3,999	$ 4,265
Durable goods manufacturers' new orders, millions	$13,511	$12,859	$12,154
Machinery manufacturers' new orders, millions	$3,998	$ 4,242	$ 3,943
New Orders for Nonelectrical Machinery (1950=100)*	151	161	125
New Contracts for Industrial Construction (1950=100)*	61	76	117

* Seasonally adjusted

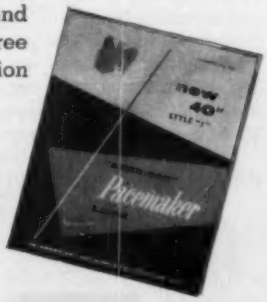


HERE'S THE *VISUAL* ANSWER!

Any question about the capacity of "AMERICAN" Lathe Spindle bearings or the stiffness of "AMERICAN" Spindles is certainly answered by this illustration.

Here is a 40" "J-9" "AMERICAN" Deluxe Model Hydraulic Duplicating Lathe (one of three, 40" "J" "AMERICANS") in the Charlotte, North Carolina plant of the Douglas Aircraft Company, Inc., boring a 54" diameter bulge die weighing five (5) tons. This illustration shows an ingenious roller rest made by Douglas but on many operations no steady rest is used.

This is a 60 horse power lathe with spindle and spindle bearings of tremendous capacities, consequently is ideally adapted to "elephant" operations of this nature and there are other exclusive design features contributing to the excellence of this big lathe, such as the extremely rigid 4-vee bed; the brand new massive 7½" diameter spindle tailstock; the patented three bearing, triple drive spindle; its 100% anti-friction construction and full automatic oiling.



The many ultra modern and superlative features of "AMERICAN" Deluxe Model Pacemakers are described and thoroughly illustrated by bulletin No. 150. May we send you one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 199 READER SERVICE CARD

Armco ALUMINIZED STEEL Tubing Cuts Cost of Appliance Parts for Manufacturer

Venturi tubes for gas ranges made of Armco's hot-dip aluminum coated tubing provide resistance to heat and corrosion at less cost

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Armco ALUMINIZED STEEL Type 1 Tubing gives you all the advantages of light weight tubular construction plus top resistance to a combination of heat and corrosion. Its special coating won't discolor up to 900 F, resists destructive scaling to about 1250 F.

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Give *your* products an edge on competition with the design-improving and cost-cutting possibilities of Armco ALUMINIZED STEEL Tubing. It's available in O.D.'s from 3/8 to 3 inches, gages from 13 to 20, and special shapes.

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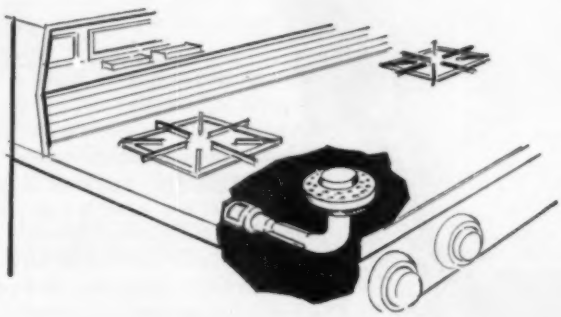

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MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Mr. K Is No Dope

The Russians are looking ahead 15 years to what their economy will be like in 1973. They hope to increase their output of iron ore 3.5 times, of oil 4 times, of cast iron and steel 2.3 times, of electricity 4.3 times.

Khrushchev hopes to carry out . . .

in the 1959-1965 period a major part of his 15-year program. He has announced the intention of the Soviets to build and put into operation in the next seven years an added 28 to 36 million tons of steel, to develop rapidly an aluminum industry, to set up 1300 automatic production lines, to have an annual capacity for making 14.7 million tons of iron castings, 4 million tons of steel castings, 3.8 million tons of stampings.

As much as possible of the Soviet metalworking industry will be mechanized. Use will be made of electronic technology to control production automatically. On the Soviet agenda is the doubling of output of "machine-building and metal processing products," as well as "replacement and modernization of old equipment."

Khrushchev is no dope. He knows that he cannot achieve a production miracle by waving a magic wand. Certain fundamental things must be done, if any sizable expansion program of production is to be realized. To increase productivity per worker is fundamental.

Khrushchev recognizes this fact . . .

He stated last month that "labor productivity in industry, which is the decisive factor for increased output and higher living standards of the working people," is scheduled to rise 45 to 50% per worker in the next seven years.

Obsolete production norms, Khrushchev stated, are still in use. It thus becomes necessary to introduce energetically well-founded production norms. They are of great importance to further growth in Russian labor productivity.

If bigger output and more labor productivity can be attained, Khrushchev believes that industrial costs can be reduced 11.5% by 1965. He is dedicated to the task of increasing productivity of labor faster than the growth of wages, "as a necessary condition for the further reduction of costs and the rise of the material well being of the worker."

The main feature of the seven-year plan is to develop further Russia's economy and to raise the living standard of the people and "thus to achieve a victory over the capitalist countries in peaceful competition." Fulfillment of the plan, Khrushchev said, will enable the Soviet Union to produce more goods per capita than Britain and West Germany.

The superiority of the USSR . . .

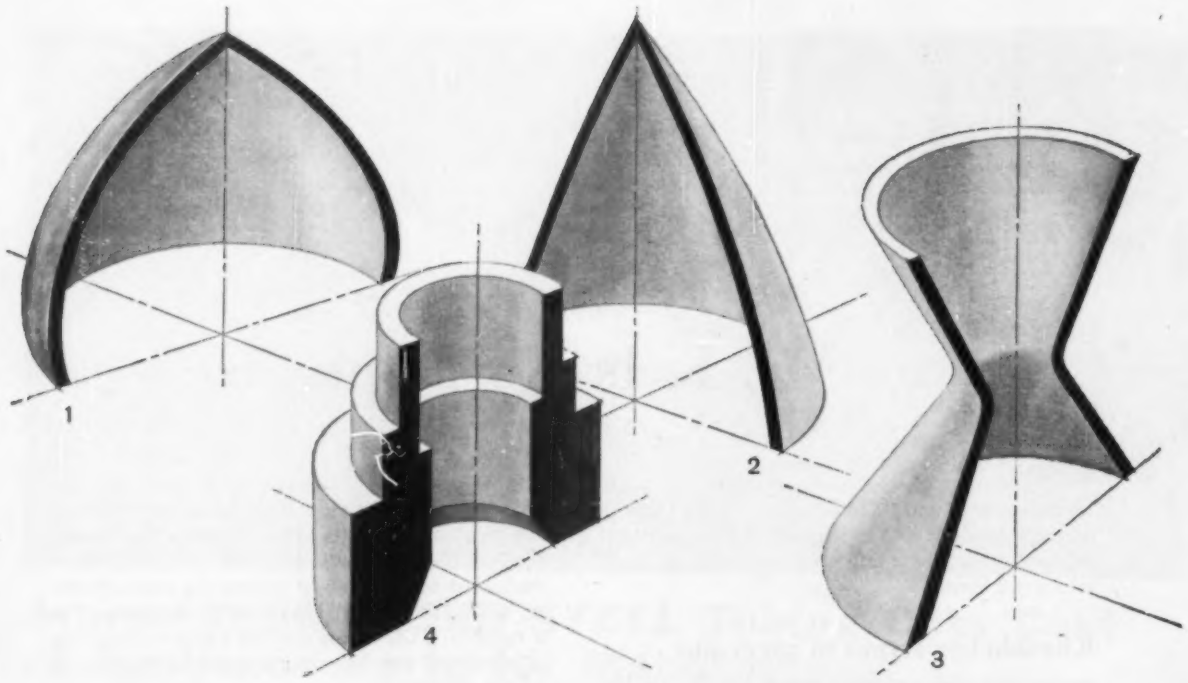
in the speed of production increase, Khrushchev boasted, will make it possible for Russia by about 1970 to catch up with and surpass the per capita output level in the United States and gain top place in the world. It will insure Russians the highest standard of living anywhere.

There, for everyone to see, is Soviet Russia's ambition to capture the No. 1 economic position on earth. One's first reaction is that of incredulity, to laugh off Khrushchev's pronouncements by saying that he is living in a dream world.

A far more sensible attitude, however, would be to take him seriously and to remember that the Russians have come a long way in the past 40 years and will make giant gains in the next decade.

Nothing would be better, at the beginning of a New Year, than for us to vow as a nation that we will keep our big lead, and then go to work to carry out that vow. Khrushchev is an able imitator, the pupil copying what the master has done. Let's maintain that relationship.

Burnham Finney EDITOR



how to Vertical Grind missile shapes

Complex missile shapes such as these, weighing hundreds or thousands of pounds, can be ground accurately on a Springfield vertical contour grinder. These machines are equally at home grinding ceramics, plastics, metals or combinations of materials. Domes (1) of any shape or Cones (2) demanding extreme concentricity can be contour ground on a Springfield. Ceramic coated parts (3) or complex orifices (4) are naturals for grinding on a standard Springfield vertical.

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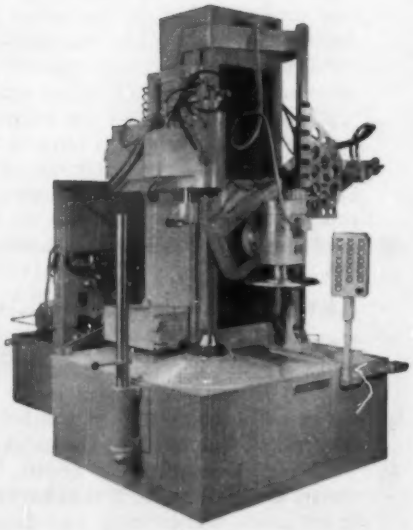
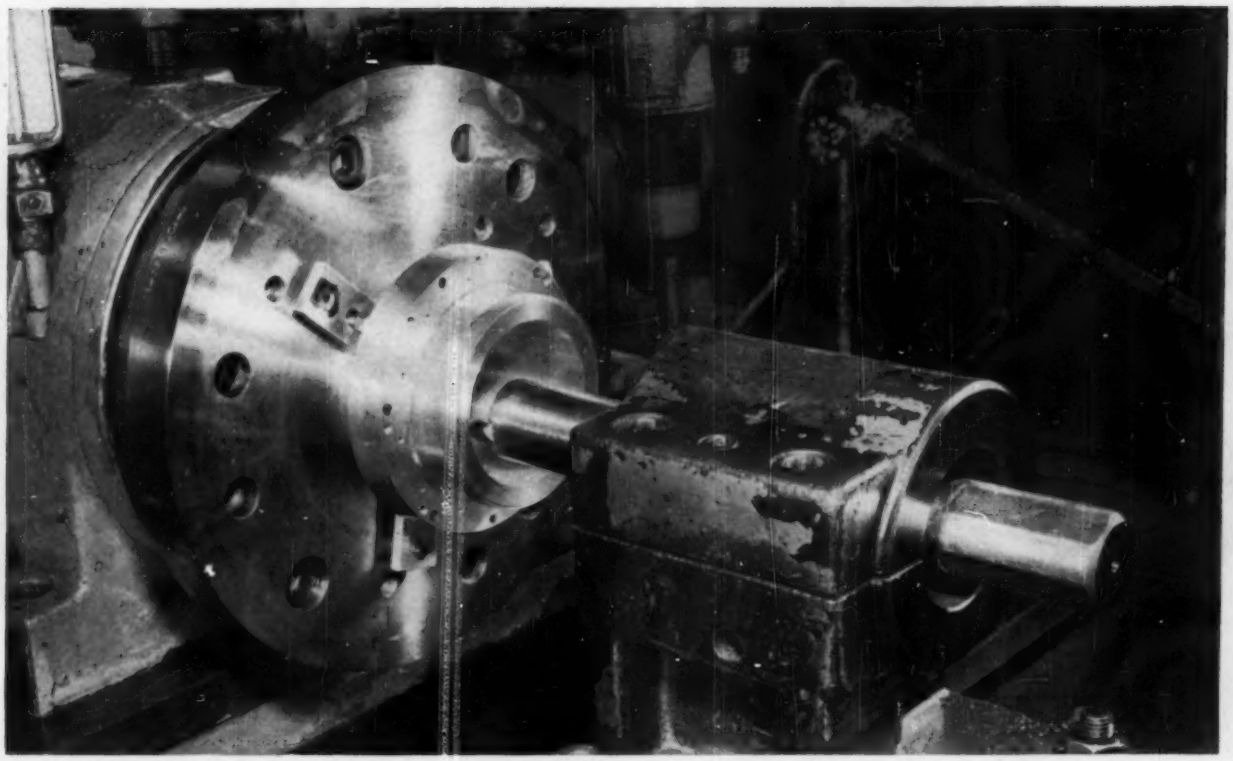


This machine accurately grinds a compound-curve dome. Both the grinding wheel and a single point tool follow a precision template. Automatic parting tools remove excess stock, top and bottom.



Air-bearing outer sleeve is precision bored on 17-year-old Heald Borematic. Work is lightly clamped to prevent distortion. Air gage checks dimensions at the machine

Plain and fancy tooling builds jupiter gyros

Joe Holzapfel, machining assistant superintendent
Tool Manufacturing and Small-Lot Shop, Ford Instrument Co

A curious mixture of simple and sophisticated tooling at Ford Instrument Company, Long Island City, N Y, produces delicate gyroscope assemblies that guide Jupiter missiles in flight. Only one objective is important—precision that will result in friction-free gyro units. These are produced for U S Army Ballistic Missile Agency at Redstone Arsenal.

Spin wheels are mounted in cylindrical housings which are supported by air where boundary layers of air are the only friction-resisting fluids. The cylindrical housings and sleeves in which they are mounted require practically perfect concentricity in the bearing units, plus fine surface smoothness. In addition, air from the pressure tank must be introduced to the bearing areas with smoothness and precision; therefore air-inlet holes must be drilled accurately.

Air bearings support an inner cylinder machined from K-monel or titanium with an integral inside rib that carries a gyro wheel. The rib must be contoured for dimension and balance, but this was a touchy milling job that took too long with small-diameter cutters.

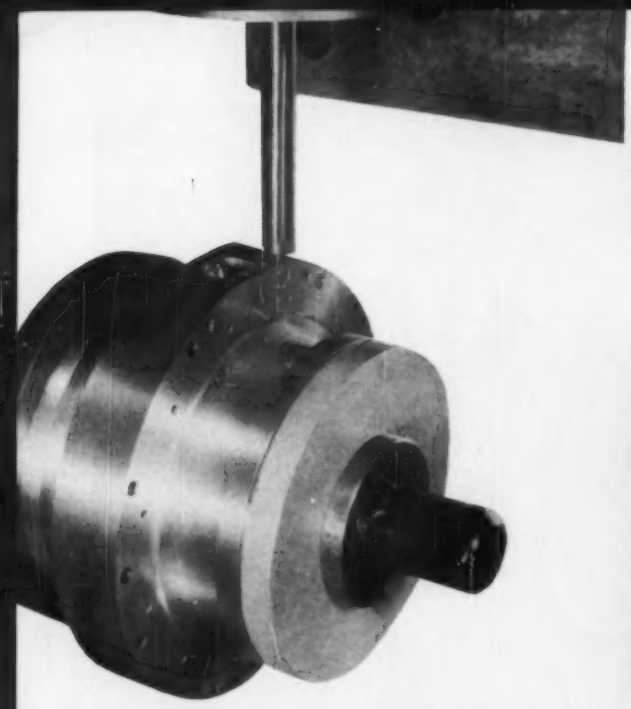
This problem was solved by electric-discharge machining (see cover photo), done with Elox equipment that saves about 70% of the milling time on each unit and produces a better finish. Tools are cast low-melting-point metal electrodes with open ends, contoured skirts, and shanks to fit the toolholder. Each tool will cut one cylinder to an accuracy of 0.005 in. before it erodes away beyond further use. Dielectric fluid for the operation is ordinary transformer oil, which is pumped through the machine spindle and tool shank into the work area, and which then flows up through holes in the tool top face and over the edge of the work to the table pump. The whole table is not flooded because the work itself forms a pan.

The Elox is also operated to salvage damaged parts, particularly to remove broken taps. Parts value is high on the gyro line—partly because of the value in the work materials, but also because each unit represents a considerable amount of labor and time. Therefore, repairs made with electrical - discharge equipment are often worth while.

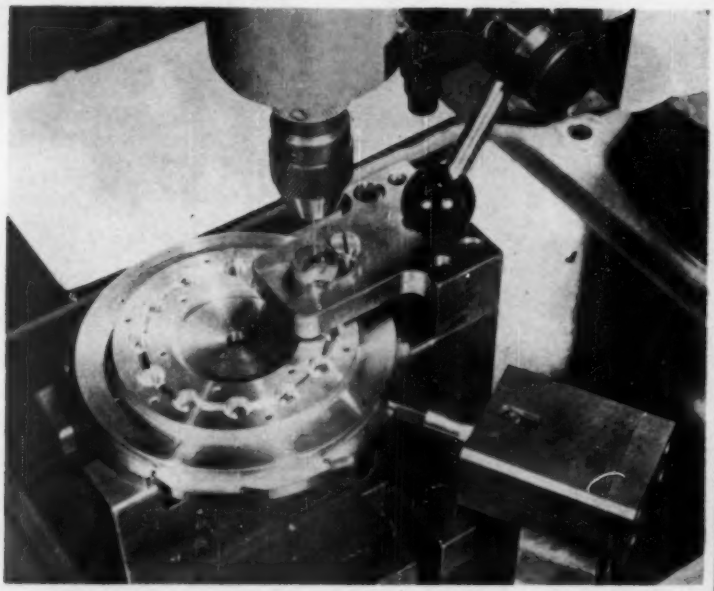
Missile - guidance elements are often produced by equipment that is deceptively simple. Production quantities are limited, and simple tooling is most economical as well as easiest to check and calibrate for accuracy.

This applies to the air-bearing outer sleeve, which is bored from 328 aluminum on an aging but reliable Heald #46B Borematic. No special precautions are taken except to chuck the work lightly (prevent distortion) and to take a fine cut with a single-point carbide boring tool (500 sfpm at 0.0004 ipr). Results are checked with an air bore gage—dimensions must be within 0.0004 in. on diameter, but roundness, taper, and squareness are confined to 0.000,-050 in. Finish must be to 16 mu-in. but 8-11 mu-in. is usually held. Subsequent lapping after anodizing fur-

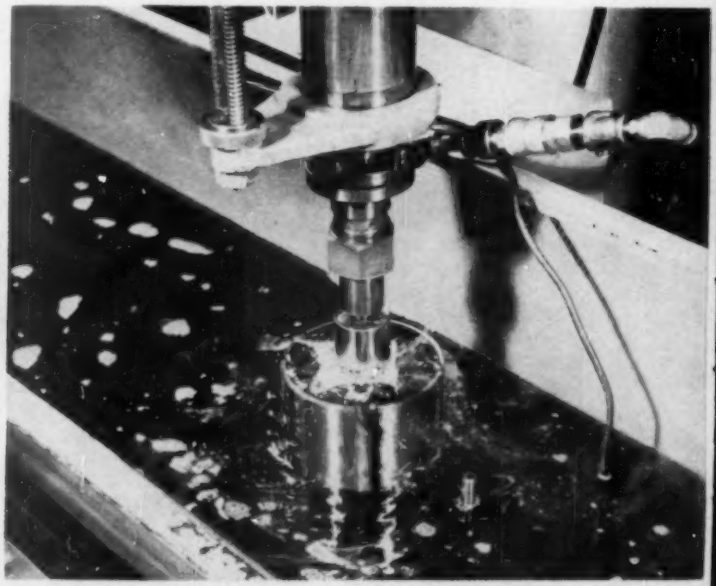
Plain and fancy tooling . . .



Air-bearing holes are drilled by an automatic rig built with a DuMore head, a Ford-designed and built double-motion spindle, and a gear and ratchet for indexing and locating. Holes are 0.028 in. in dia, and must be aligned to the sleeve center within 0.0005 in. Sleeve has 4½-in. OD



Bearing end plate is drilled to +0.0005 −0.0000 to space air inlet holes (0.028 in. dia) equally around the circle. At each index the bushing is lifted, then seated in the 5/16-in. hole in the plate to center the 0.028-in. hole

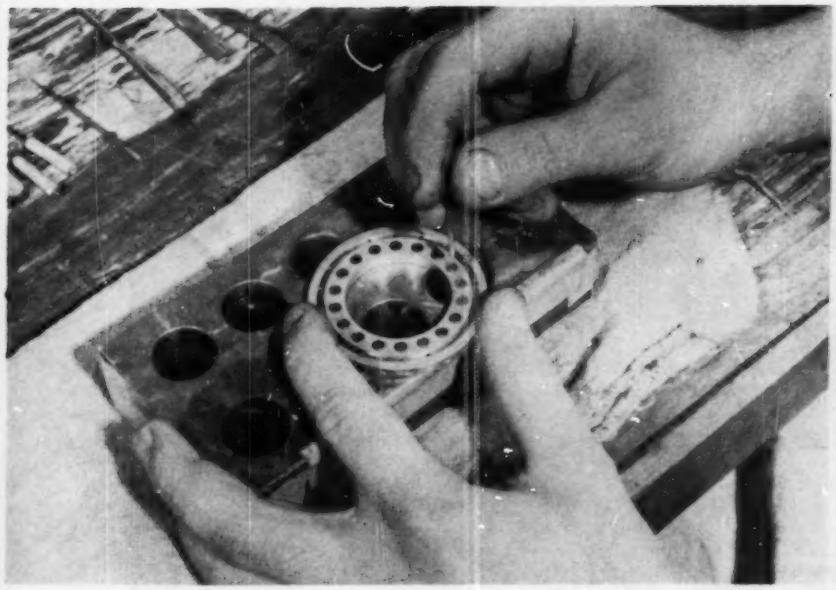


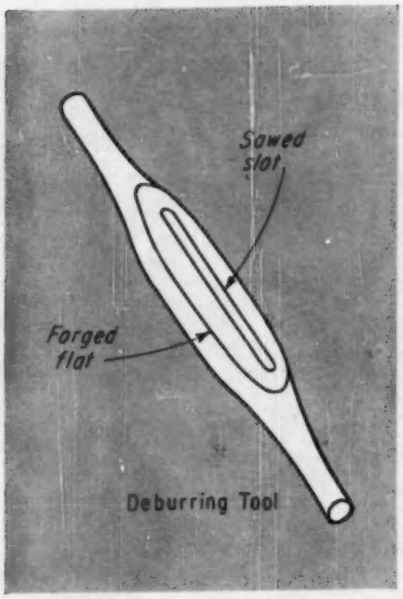
Inner cylinder is Elox-machined to produce contour on inside rib that supports a gyro. Electrode is a cookie-cutter shape with holes that pass oil. Die-cast tool need not be ground

ther refines the finish to approximately 4 mu-in.

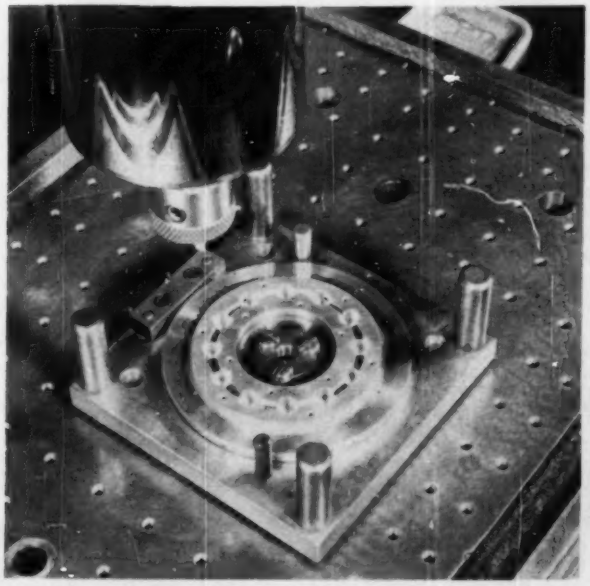
The same sleeve is drilled radially through the wall to produce air-inlet holes. These must be spaced equally around the OD so air will feed uniformly from the pressure tank, and so air-bearing support will prevent the cylinder from touching the sleeve at any attitude of the missile in flight. Though the indexing setup is quite accurate, alternate holes are drilled, then the sleeve reversed and the remaining holes drilled. This pairs the holes so any slight deviations will be evened out.

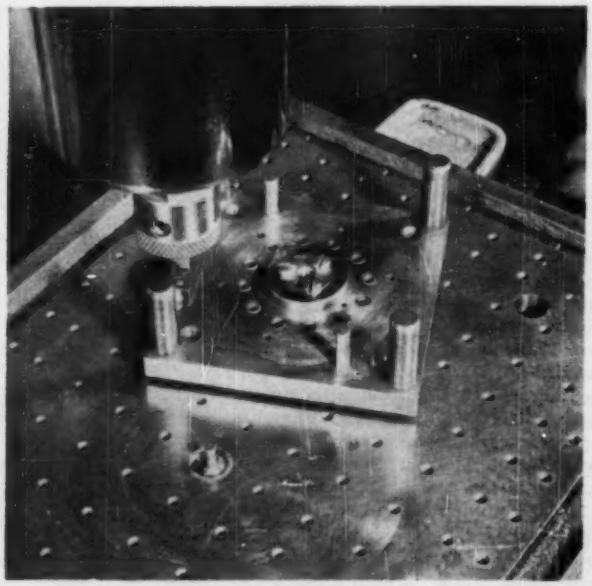
Drilling and boring are done on sensitive drillpresses and jig borers





Small holes are deburred in air-bearing plate by specialized hand tool. Wire is forged to produce a flat, then the flat is slit with a small saw to produce a needle-eye shape. This removed burrs at both ends of the hole and burnishes the ID





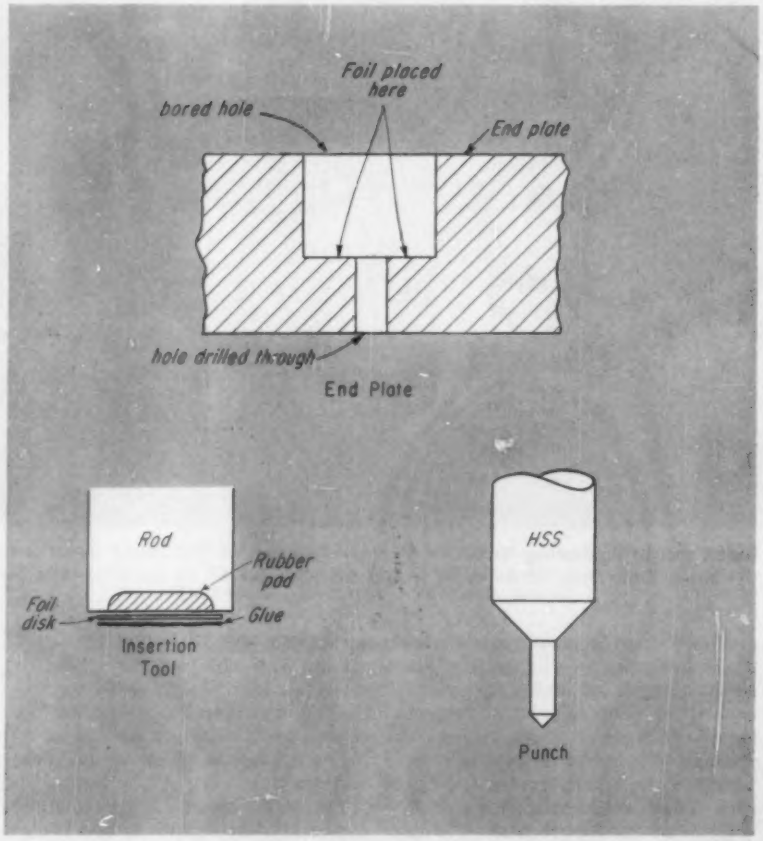
Index pin in jig-boring table simplifies hole locations for end plates. Large holes are drilled by loading end plate into a master fixture fitted with drill bushings on the bottom. Index pin is raised by pedal to locate a bushing

equipped with master index plates. These inexpensively, accurately, and consistently allow matching hole locations on both sides of such parts as air-bearing end plates. The setup is made with a fixture plate that has precision drill bushings on the bottom. These are located by a retracting pin in the fixture base—the pin is aligned exactly with the drill spindle so a hole will be drilled or bored exactly in line with the retracting pin, and therefore will be aligned with all other holes according to the layout of the master plate and bushings.

This arrangement allows drilling any kind of hole circle or odd layout as long as a master plate with accurately located bushings is built for the job.

Even deburring gets special treatment where burrs around edges of holes are more in the category of extrusions than burrs—an extrusion of metal around a hole of as little as 0.0001 in. is not acceptable. These

Foil is punched at microscope fixture. Foil disk is located on shoulder inside larger hole after end plate has been adjusted so small hole is centered above punch. Then 0.004-in. hole is punched through foil



are critical at the edges of air inlet holes where any minor variation may disturb the flow. Among special tools developed for deburring the precision holes in end plates is a needle-eye tool made by flattening a section of 0.012 in. diameter wire, then slotting it 0.005 in. wide to make a needle-eye shape. This has spring action as it is inserted in the hole and spun to remove the burr.

More complex equipment includes optical devices with which these air-inlet holes are inspected and finally assembled. Air enters a 5/16-in. counterbore to pass through a 0.004-in. hole pierced in a disk of foil cemented to the bottom of the counterbore. Then the air passes through a 0.028 in. hole and into the air-bearing area. This hole is designed with a fixed diameter-length ratio that will control flow into the bearing. To pierce the small hole in the foil, an operator centers the 0.028-in. hole visually through a microscope, then pierces the foil by means of a lever-operated vertical punch.

EXPLOSIVE FORMING

—Successor to the heavy press?

It's taken less than 10 years for explosive forming to become one of metalworking's hottest new techniques. Already getting into the act with intensive research and development into the science of moving metal with propellants are such giants of U S industry as Olin Mathieson, Convair, Lockheed, Pratt & Whitney Aircraft, and Du Pont.

Why all this sudden interest? For one thing, **explosive forming* can move metal at rates of 100 to 300 inches per second—compared with a rate of 1 to 10 inches per second with most presses.**

For another, **explosive charges teamed up with small dies and small presses can do metal forming jobs that up to now could only be accomplished with the Air Force's giant (35,000 and 50,000 ton) hydraulic presses.** And small dies, small presses and a few ounces of explosive add up to only a tiny fraction of the cost of the huge, fabulously expensive Air Force heavy presses.

Technique Only 8 Years Old

Explosive forming is still technically in its infancy—the first known application was undertaken in the manufacture of industrial fans by Kansas City's Moore Co just eight years ago. Then in 1953 Olin Mathieson became interested, by 1955 was going great guns at its Winchester and Western Divisions in a search for new techniques to which such packaged propellants as blank cartridges and explosives could be applied.

A major result of Olin Mathieson's efforts along these lines has been to cut down drastically on the number of separate operations involved in forming a part.

For instance, conventional press methods of producing stainless sound suppressors for the Boeing 707 required 13 steps: (1) shear two blanks, (2) form first stage—two parts, (3) form second stage—two parts—anneal and pickle, (4) form third stage—two parts, (5) form final stage—two parts, (6) trim and inspect, (7) weld, (8) trim and inspect, (9) size—first stage, (10) size—second stage—and anneal, (11) size—final stage, (12) flange end, and (13) trim, identify and inspect.

Olin Mathieson has cut this down to six operations: (1) shear one blank, (2) roll, (3) weld, anneal, pickle, identify and inspect, (4) explosive form, (5) flange end, and (6) trim, identify and inspect.

Among other things, explosive metal forming eliminates several annealing steps, and all that is needed to form a jet sound suppressor is a clamping press and a propellant charge. **Producing these parts by conventional press methods, it is estimated, would cost maybe $500,000 to set up the operation alone. The same job, done by explosive forming, costs $15,000 to $20,000.**

Here, step by step, is how Olin Mathieson makes a noise suppressor:

- A sheet of 321 stainless is rolled into a tube, welded by conventional means, and inspected for flaws.
- A "medium" (an energy transmitter, such as water, which causes the explosion's force to spread evenly through the tube) is placed inside the tube.
- The tube with its medium and a packaged power cartridge (an igniter and controlled-burning-rate smokeless powder) are inserted into a die.
- Die is in a hydraulic press, allowing the die halves to be separated so tubes can be inserted, closed and clamped.
- A vacuum is drawn between the die and the tube, which has been sealed by caps on both ends.
- Charge is ignited.
- Tube is removed from the press, cleaned and inspected.

One advantage of explosive forming over conventional methods is that "corners" can be formed easily, i.e, metals can be given sharp changes in direction, or can be turned sharply in different directions with less chance of the metal breaking—something a conventional hydraulic press can't do.

In its early stages of experimentation, Olin Mathieson used 8 and 12-gage shotgun blanks for the charge. Today, new and special charges have been developed.

In missile manufacturing, explosive forming has overcome the inherent lack of smoothness that occurs when sections of missile bodies have to be welded together. That's because the new method can do a number of jobs—bending, cupping, and flattening, plus several others.

Currently, one of the aircraft industry's major problems is finding a "skin" to cover the honeycomb structures used in airframe construction. The problem is to get the stainless sheets very flat to insure high strength in all brazed joints. No really effective method for flattening sheets to close tolerances exists. Scrap is high and costs are high. For example, in an 8-ft-long, 3-in.-thick sheet of stainless honeycomb (value $24,000) one little wrinkle or a small defect in brazing makes it unusable. Olin Mathieson is currently working on flattening these wrinkles with explosive methods.

Missiles are staged so that one section can separate from another. Now, explosive bolts allow these stages to separate at a precise time, and these bolts have thrust built into them.

Other developments using "packaged power" are being tested. Olin Mathieson believes it has perfected a primer-actuated photoflash bulb which would do away with the need for a battery.

O-M's Ramset facility, which uses the power of a cartridge to seat a multitude of fasteners, has perfected a hole puncher which could cut hole drilling costs more than 50% for the aircraft industry. This tool would merely be placed against the steel and fired and the precise hole needed would be made. The current cost of drilling a hole in the harder heat resistant aircraft alloy is 5¢ to 30¢ per hole.

Olin Mathieson is also making missile nose cones of exotic metals by explosive forming.

At Ramset, too, a 22 caliber cart-

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* Details on Moore Co's explosive forming work may be found in AM—Oct 25 '54 p173 and AM—Apr 21 '58 p137: on Lockheed's work along the same lines in AM—Jan 14 '57 p113 and Nov 17 '58 p123: and Convair's in AM—Apr 21 '58 p137.

ridge is inserted into a small press, fired and ash trays are made on a mass production basis.

Sketchy experiments conducted over the last few years have proved that many so-called "unworkable" alloys can be worked if the speed of forming is very high. For example, heat treated 6A1 4VA titanium alloy sheet can be bent to a radius equal to 16 times the material thickness if the bending is done at room temperature on a conventional power brake with a blade velocity of ½ to 1 ips.

The same material, formed by a powder-actuated tool (when blade velocity is increased to several hundred fps), can be bent to a radius equal to the metal thickness. Springback, or recovery of the metal after bending pressure is relieved, is reduced from 60° to 5°.

Weight, in aircraft and missiles, is of extreme importance. On the F104 fighters, a 1 oz increase in structural weight eventually compounds into 1½ lb (2400%) increase in gross weight. An increase of 1 lb may involve a completely different power plant than originally contemplated.

The increase in overall dimensions of a simple structural stiffening member, because of the large bend radius required for conventional forming, involves a structural weight increase of 30% to 50% over a member formed by high velocity or explosive methods. For a 12-ft, 0.060-in. stainless steel stringer angle 1 by 2 in., this could amount to 2½ lb per stringer.

The use of high velocities was applied experimentally to other simple fabricating operations at O-M. For example, a multiplier was incorporated in punchpress ram movement to obtain blanking, piercing and forming velocities 5 to 10 times normal. Better holes, more uniform forming and closer tolerances resulted—but the equipment fell apart.

Experiments conducted by a manufacturer of stainless steel fan hubs and fan motor housings indicated another application—this time dynamite in water was used to bulge a cylinder into a spherical shape.

Two Research Goals

Of all the fabricating fields involving the possible application of explosives, two have been chosen by O-M's Winchester-Western Division for concentrated effort:

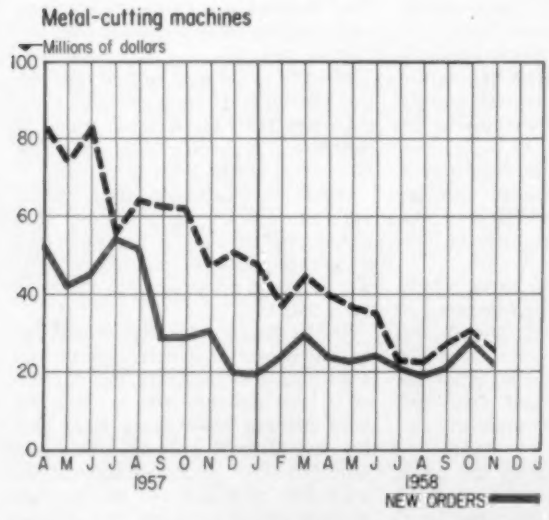
- **Use of powder-actuated tools to accomplish piercing of fastener holes,** which is being concentrated to develop exact velocities required to produce close tolerance holes in hardened sheet material. After the requirements have been established, tooling will be developed.

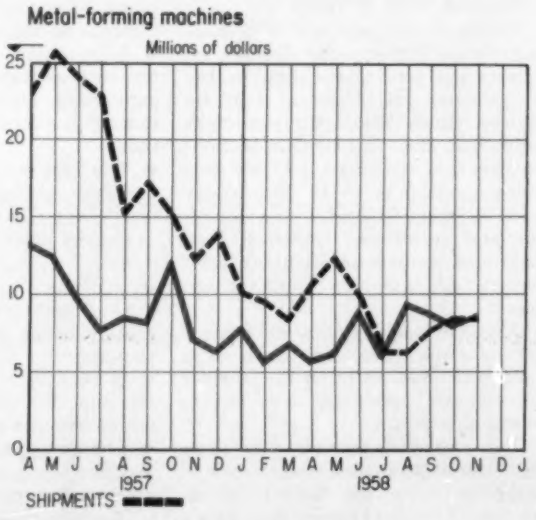
Experiments have proved that cartridge-actuated captive piston tools can produce holes within standard dimension drill tolerance which are free from burrs, are cylindrical and have smooth interior surfaces. Holes with little or no effect on surrounding material (no measurable change in residual stress level) can be produced. Tool wear is far less than the normal wear on slow acting punches.

Cost of making holes in hard and hi-temp alloys runs to about $700,000 per month for Lockheed, Douglas, North American and Northrop. For the entire airframe industry this amount may be quadrupled. The cost per hole averages 11¢. A "guesstimate" of the cost for producing a hole by high velocity is somewhere between 4¢ and 6¢ per hole or 50% of the present cost—a potential aircraft industry saving of over $4 million per year.

- **Use of propellants or explosives to form sheet metal parts** (gages under 0.25 in.) where major forming can be done by propellant powders. Considerable time and effort has been expended to develop methods and techniques using gunpowder and high explosives to do relatively simple forming and sizing operations. Most has been spent in determining if a specific part could be made.

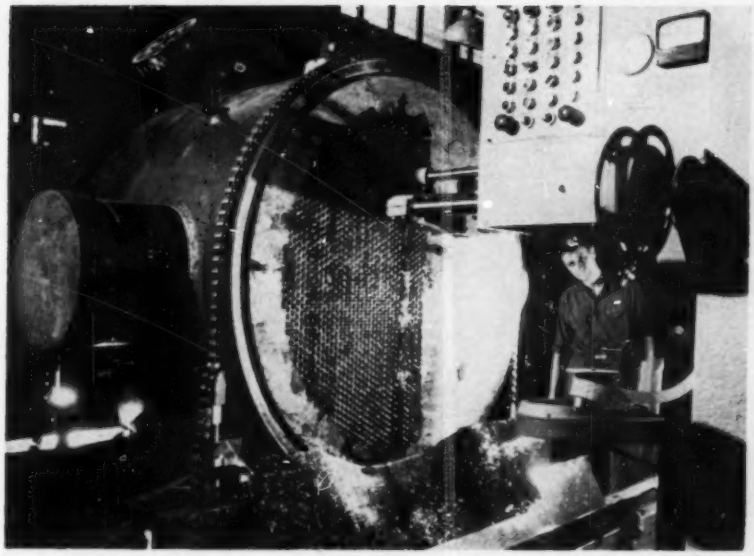
Recently, however, a planned program has been started to determine basic metal behavior under high velocity loading and the effect of shock waves, both on part and on die.

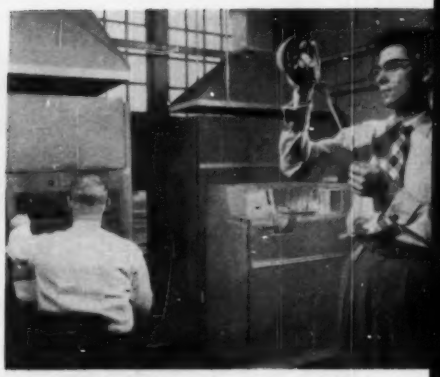




Machine tool orders and shipments drop in November

MACHINE TOOL NEW ORDERS AND SHIPMENTS, as recorded on the National Machine Tool Builders' Association Index, presented a mixed picture in November. New orders for metal-cutting machine tools declined from October's $28.45 million to $20.85 million, and shipments dropped from $32.65 million in October to $24.5 million in November. New orders for metal-forming machine tools, on the other hand, rose to $8.55 million in November from October's $8.45 million, but shipments in November fell to $8.1 million from October's $8.5 million. Press-time figures are based on about 80% industry reports





Thousands of holes . . . in tubesheets formerly were located manually. The quantity considerably multiplied the odds against successful completion. Now the hole pattern is computed on an IBM 650 and put on tape in minutes. Rejects are minimized

Tape + Target Drills take toil from tubesheets

Engineers at the thermal products division plant of ALCO Products, Inc, (Dunkirk, New York) have united an IBM 650 computer with automatic tape-controlled target drilling. The overall cost reduction in drilling thousands of holes in tubesheets, forgings of high-quality steel that cost $15,000 or more before drilling begins, is more than 35% under the old tedious and less-accurate radial-drilling method.

Two deep-hole drilling machines built by the Lahr Machine and Tool Corp (Toledo, Ohio) are used, under tape control, for both gun and target drilling. In gun drilling, cutting is done with a single-point cutting tool, and coolant at pressures up to 1000 psi forces the chips away from the point of drilling. In target drilling, the cutting tool trepans about the center, producing both chips and a center pin that is expelled by air when the hole is completed.

Savings with computer-produced tape control and the target- or gun-drilling method vary with the thickness of the tubesheet. With the former radial drill and twist drilling method it was extremely difficult to maintain alignment tolerance in a tubesheet over nine inches thick because of the danger of drill drift causing holes to run together on the reverse side.

Target drilling machines all but eliminate this danger. They hold accuracies of 0.001-in.-per-ft of depth in contrast to the former drift accuracies of from 0.004 to 0.006 in. drift in depths of 9 or 10 in. And under the new method the 0.001 in. drift accuracy can be held in depths up to 24 inches—greater than the thickness requirements of tubesheets in existing design conditions.

Several years ago ALCO-Dunkirk applied the IBM 650 computer to the then time-consuming task of rating heat exchangers—selecting the proper tube design characteristics to meet a given application. This procedure cut from hours and days to minutes the basic design work, but a method of speeding shop-floor techniques, to help manufacturing keep up with the modern design-engineering approach was still needed.

Vertical radial-drilling of tubesheets had been used for years. It not only was too slow but also had too large a margin for error. And design pressure was increasing the problem.

Ten years ago the average ALCO-designed feedwater heater was built for pressures in the neighborhood of 2500 psi. Today ALCO and the industry in general is designing and building for applications double and over that amount.

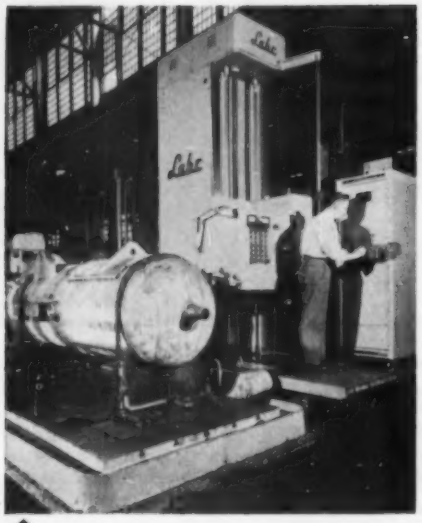
As the system works today, ALCO's computer section receives the tube layout from design engineering, and then figures the input data for the program by feeding into the data-processing machine the pitch, number of tubes per row, total number of holes, and other pertinent information.

When this program is completed, the design engineering department checks the computer input sheets for miscalculation, and following this a set of "check program" sheets are completed. Then the IBM input cards are punched, and from them the computer produces the *X* and *Y* coordinates and travel direction for guiding the Warney & Swasey Research Tele-Probomat system.

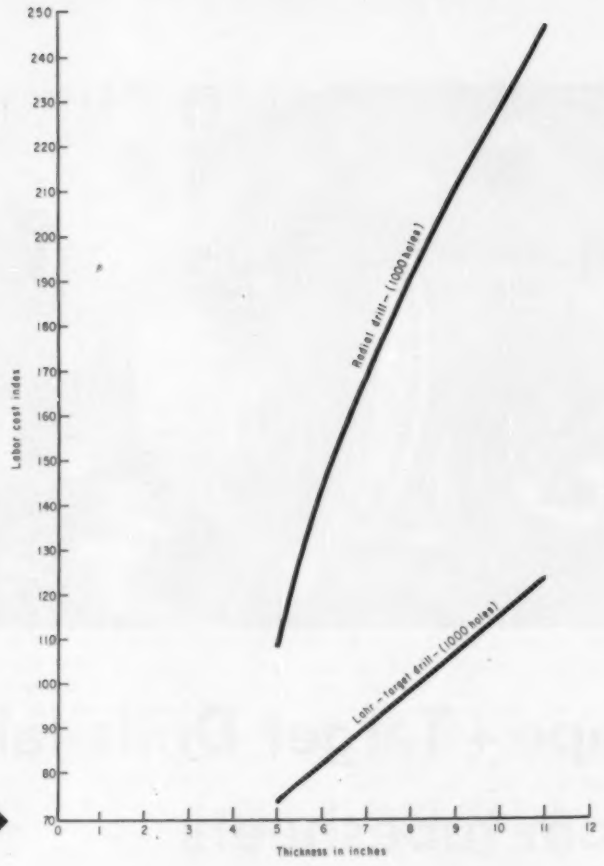
Output cards from this program are fed back to the computer, which seeks errors by comparison with the check program. Results are verified by a mathematician, and then the tape to be used for machine control is punched on the IBM card-to-tape machine.

Then, when complicated tube pat-

Tape and target drills . . .



Flexibility . . .
is an outstanding quality of the numerically controlled machine. A variety of jobs can be done with greatly reduced lead time



Labor cost . . .
per 1000 holes increases with plate thickness but tape control stabilizes the rate of increase as thickness increases

terns are involved, a second set of cards may be punched from the tape and the resulting deck compared to the card-to-tape input deck on a collator. From this stage, in either case, the tape is issued to manufacturing and the horizontal target drill is set to go.

The computer calculates 100 tubesheet hole locations per minute and the card-to-tape operation spots 160 hole locations per minute—ample evidence of the time saved in comparison to the former manual method of locating holes.

In the Shop

At the manufacturing point, ALCO uses the Tele-Probomat controlled drilling machines, which are designed for speeds from 300 to 5000 rpm under direct drive, with positioning range of 6 by 6 ft and a maximum drilling depth of 24 in., as mentioned previously. The machines are infinitely adjustable and are calibrated by verniers. Hydraulic feeds range from one to 40 ipm.

In a typical application at Dunkirk the setup automatically drills two 7-in. tubesheets "stacked" together with more than 2,000 tube holes in each. Drills used for this work range from 3/16-in. to 1¼ in., having either one-piece brazed tips or detachable tips, depending upon the drill diameter. Cutting edges and wear strips are carbide and the tip and shank are high-speed tool steel.

Speeds and feeds are set for any one hole, and can be adjusted as desired on the same hole—increasing both within the range of operation to compensate for the tubesheet material. This adjustment is regularly used for drilling tubesheets clad with stainless steel. Cladding normally amounts to about 10% of total tubesheet thickness.

With the Lahr drills, speeds and feeds are reduced for cutting through the stainless-clad portion of the tubesheet, and then increased automatically, according to pre-set control, when the drill hits mild steel. This adjustment in inches per minute drilled can be repeated for each tube hole.

Improvements in drill grinding and drill design have made it possible for ALCO to apply a feed rate of 6 to 8 ipm versus the 2 to 3 ipm rate that was maximum with the radial twist method.

Mechanics of the Tape

The Warner & Swasey Probomat used in this system operates from standard 8-hole, 1-inch perforated Mylar tape. Tape information is stored in the control console. Autoset units are attached to the actuating elements of the machine.

Each movement is divided into *coarse* and *fine*, so that the target-drilling machine receives a "coarse position" signal during its rapid traverse from one hole position to the next, and then a "fine signal" for the definitive positioning point.

Autoset units are actuated by instrument servos, while the machines themselves are operated by ordinary electric motors. Simultaneously with the X and Y coordinates fed to the machines, the Probomat provides signals for various additional functions as required.

From the labor-index comparison, it can be seen that for any thickness of tubesheet tape-controlled target drilling shows a bottom line "plus." With the initial bugs eliminated, ALCO places total system efficiency at 98%. Tooling costs are about equal, for work holding, to those when radial drilling. Setup time is slightly higher because of mounting work horizontally but time is regained many times over in production.

Ultrasonic welding hunts bigger game

Ultrasonic welding, already a valuable tool for joining the fine wires and foils of the electronics industry, is growing in capacity and versatility to the point where it presents a challenge to conventional equipment for spotwelding aluminum. It also shows promise for joining some of the high-temperature materials.

Units now on the market can join aluminum in thicknesses up to 0.100 in. with tensile-shear strengths well above military specs, and more powerful machines are on the way. In addition, the welds are claimed to be more consistent than resistance welds.

The equipment is a little more expensive than comparable resistance welders, but lower installation costs make up much of the difference. An ultrasonic machine is normally caster-mounted so it can be moved around at will, and it can be plugged into a 220-volt line. In operation, the power required for welding aluminum in thicknesses of 0.070 to 0.080 in. is 4 kva for the ultrasonic unit vs 50 to 75 kva for the resistance welder.

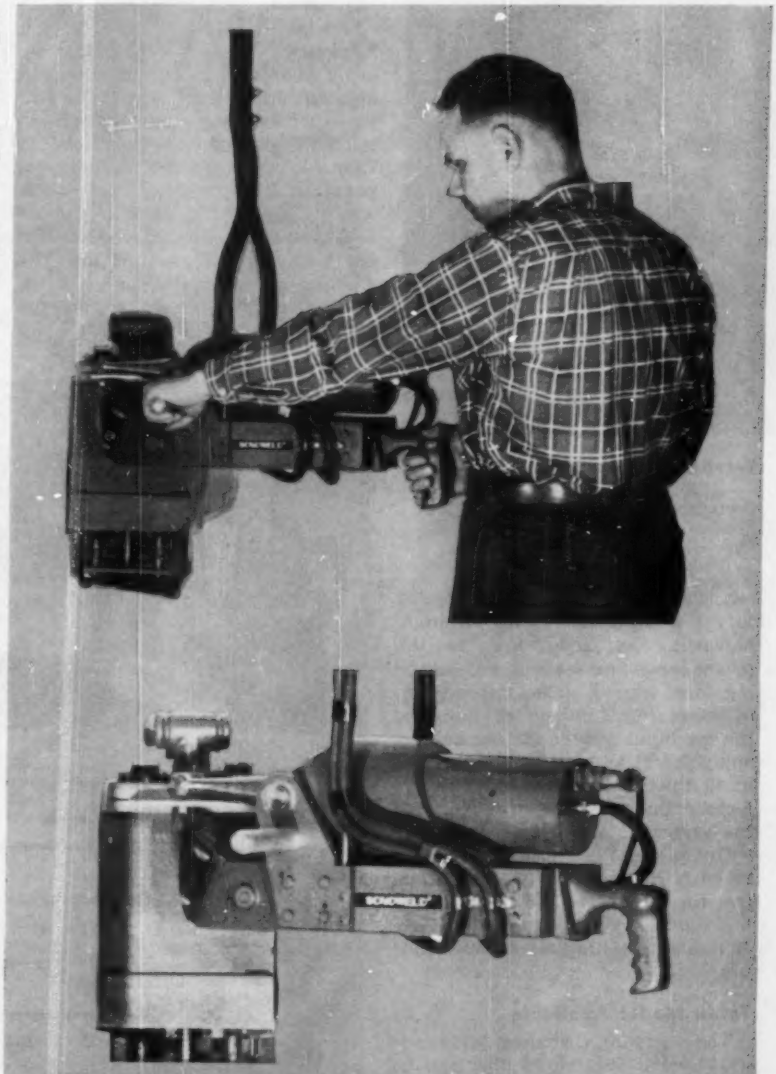
Lower Cleaning Costs

Cleaning costs, too, are lower, because ultrasonic welding does its own cleaning. The vibratory action breaks up and disperses surface oxides and contaminating films. Degreasing alone is adequate preparation for Alclad and other bright-finish aluminum surfaces. Bare aluminum alloys require only one deoxidizing operation. Moreover, the elapsed time between cleaning and welding —usually held to a few hours for resistance welding—does not appear to be significant.

Weld Can Be Made Cold

Another advantage is that the ultrasonic weld is made cold, in the metallurgical sense. Some heat is generated at the weld but not enough to melt the material or to change its characteristics. Instead of producing a nugget of cast material, the process leaves the metal in its original wrought condition and does not create a "heat-affected zone" surrounding the weld.

Because of this feature, J Byron Jones, president of Aeroprojects, Inc, foresees a promising field of application in high-temperature materials whose physical properties are harmed by other joining methods. For instance 6A1-4V titanium (2 pieces, each 0.040 in. thick) can be welded with a spot strength of 2260 ± 180 lb.



Portable gun adds flexibility . . .
. . . to ultrasonic welding technique. Power cable is only about ½ in. in dia, and air line for clamping is about the same size

Welds between dissimilar metals are another specialty of the process. One example of present capabilities is 0.028-in. titanium to 0.025-in. stainless with a spot strength of 940 ± 30 lb. Here, the titanium is 5A1-2.5Sn, and the stainless is 430.

Aluminum-to-copper welds will grow in importance, according to Jones, along with the trend toward aluminum conductors for electricity. Aluminum wires and bus bars will still need copper terminals, because copper is easier to work with in the field, and ultrasonic welding can easily make the necessary joints. In tests, 0.042-in. copper has been welded to 0.061-in. aluminum (1100-H14) with an average spot strength of 850 ± 30 lb.

In the early ultrasonic-welding equipment announced several years

Westinghouse enters its bid . . .
. . . in ultrasonic competition with prototype seam welder

ago, very low forces were applied to the welding tips. Later research, however, has shown that, as the power input is increased, the clamping force must also be increased to maintain consistent welds. Some of the machines now on the market can apply forces as high as 1000 to 1200 lb to the welding tips without affecting the vibration frequency of the system.

One of these is a 4000-watt welder recently introduced by Sonobond, Inc, the newly created manufacturing subsidiary of Aeroprojects, Inc. It is also planning on an 8000-watt unit.

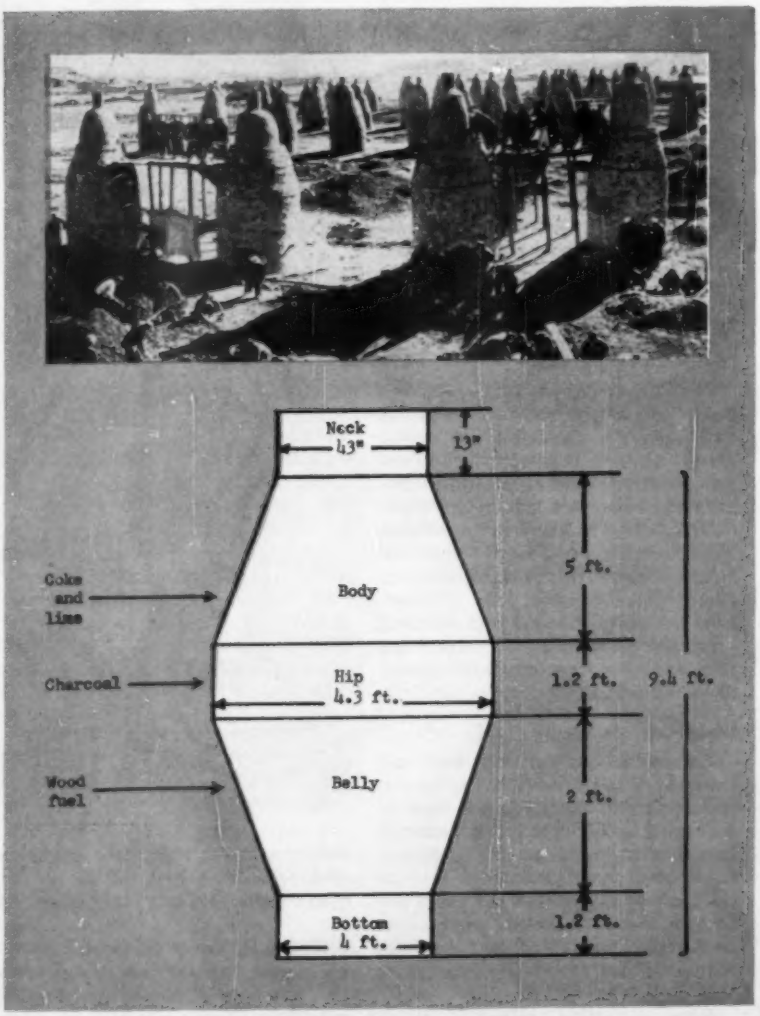
Table Model Available

The company's smallest welder is a 100-watt table model that can be equipped with a microscope for positioning extremely small components. The larger units include spot welders, roller-seam welders, and a portable welder that can operate as far as 150 ft from the power supply.

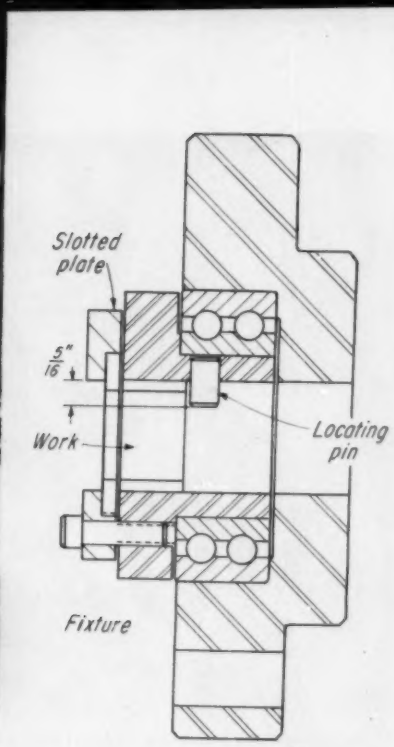
A new entry into the ultrasonic-welding field is Westinghouse Electric Corp. The company announces that it has developed a roller-seam welder in which the two wheels vibrate in opposite directions. The transducer for each one is supplied with 500 watts of power. The equipment is in the development stage, but investigation is being continued to increase the welding speed and the thickness of the metals that can be welded.

Red China's 400,000 "backyard" smelters may double iron-steel output this year

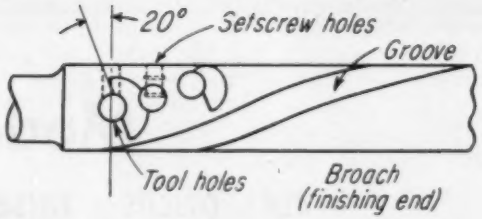
Operating on the theory that an army of ants given enough time can accomplish miracles, Red China this year hopes to turn out 10.7-million tons of iron and steel. The "ants" of China's plan are its millions of peasants. The "anthills" are small, weirdly assorted steelmaking ovens —400,000 of them—scattered through the backyards of rural China. The Chinese government's don't-just-sit-there-do-pushups idea is to have local farmers turn out a pig or two (of iron, or at best *very* low grade steel) a day in what little spare time they have. If the plan works, and there is every indication that it will, China this year will add 6-million tons of iron-steel to its output—and that's more than double 1957's 4-million tons. Trouble is, the product of these backyard furnaces is spongy iron of such low quality that it may be impossible to convert to steel.



Backyard furnaces date back to the Eighth Century . . .
Furnaces like these were in use in China about the time Charlemagne ruled Western Europe. Today, a large part of China's 100-million people spend their spare time smelting iron in them, feeding them with poor-quality coke, anthracite, sub-bituminous coal, and even peat. But product quality is very low.



Bushings are broached . . .
in No. 3-36 Colonial machine. Slotted fixture plate is removed to clear finished workpiece, then replaced to clamp new part in cutting position



Helical broach cuts bushing cost 40%

By J I McNally, factory mgr, Kell-Strom Tool Co, Wethersfield, Conn

Opposed spiral grooves were cut in Oilite aircraft bushings by a broaching tool designed, built, and operated in a shop that made a bid 40% below the next lowest bid for the job. Inserted teeth, special tool angles, and a simple spiral device made it possible

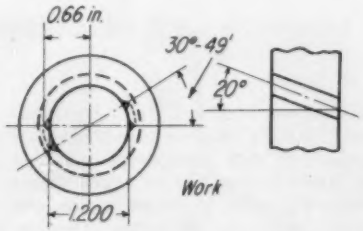
This helical broach met a short delivery date, beat competitive prices, and allowed inserting HSS teeth with the best cutting angles for the job. It was built to cut two opposed grooves inside Oilite aircraft bushings 15/16 in. long and 1.200 in. across the ID. The grooves were spiraled at a 20° helix angle, and were cut 0.006 in. deep.

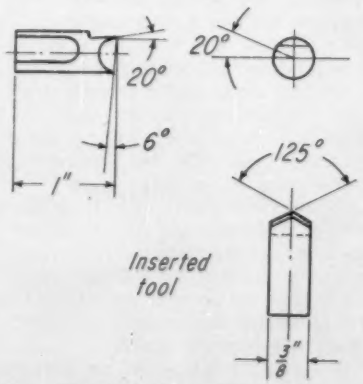
The job was planned for a horizontal Colonial broach, where a workholding fixture was installed with a short vertical pin fixed close to the work. This pin would engage a helical groove cut in the broach body to twist the tool as it cut, producing the spiral groove shape.

Tool Construction

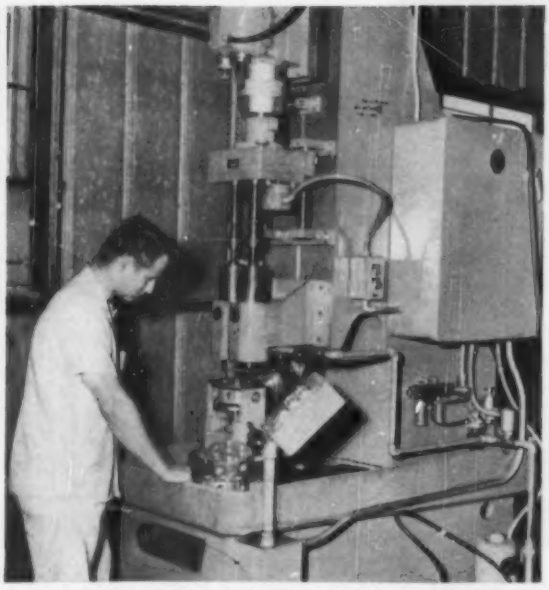
The broach body was machined, then heat-treated to R_c 40, which was hard enough to suppress wear, but soft enough to allow later machining. Then a setup was made on a Milwaukee 3CH plain miller with a dividing head working off the miller leadscrew. The helical groove was machined first, then 24 tool holes —12 on each side, pitched 9/16 in. apart—were drilled at the same helix angle. Finally, 24 setscrew holes were drilled and tapped at right angles to the tool holes.

The bushings were machined on an HEB contour lathe at 4500 rpm, which provided fine finish and accuracy of ±0.0007 in. on the OD, which located the work in the broach fixture. Broaching was done at 15 sfpm with Vantrol 523 applied as the cutting fluid. Extra-large clearance angles on the inserted cutter teeth were required because the material machines somewhat like cast iron.

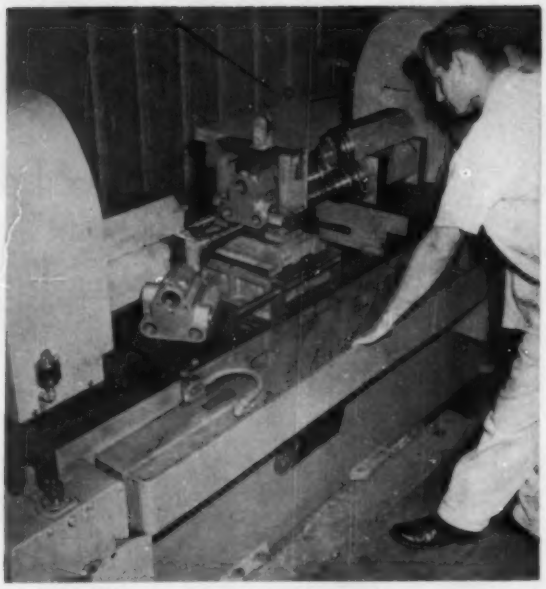




Broach body is tapered . . .
from starting to finishing end, so all cutting teeth can be inserted and gaged to project equal amounts from their holes. Bits are clamped after being located with simple setting gage that fits over bar and has slot to let depth micrometer reach tool tip



Drill turrets are bored at high speed on a Wisconsin 3-spindle machine. Three boring bars cut eight diameters simultaneously on three indexes, holding locations to ±0.003 in. and diameters to ±0.0001 in.



Both bodies and bases are bored on Wisconsin horizontal machine. Removable fixtures accommodate the two parts in turn. Bodies are machined in 4 min (opposed to 15 min formerly) and bases in 3 min (opposed to 11 min)

Modernization

• cuts prices • raises profits • speeds delivery on turret drills

Burg Tool & Mfg Co is a machine-tool builder that practices what it preaches; new equipment installed to build a new line of bench turret drills cut costs, increased profits, and made quicker deliveries possible. And the new line of machines was brought out ahead of schedule.

One lot of the new turret drills was produced on existing old equipment, but the manufacturing cost by this method was higher than the originally established selling price for the product. The old line couldn't come close to breaking even.

Investigations showed that improved methods using new equipment would permit cutting the original sales price of $1000.00 almost in half. Now the price of the new model "O" bench turret drill is $550.00, including a normal profit.

Some parts produced by outside vendors were brought back into the shop for more economical production. One grinding job that cost $9.00 outside was made for $0.58/unit. Another precision part that cost $35.00 outside is now made in the plant in 3½ min at much lower cost. In addition, scheduling problems have been reduced by bringing more of the production into the Burg plant.

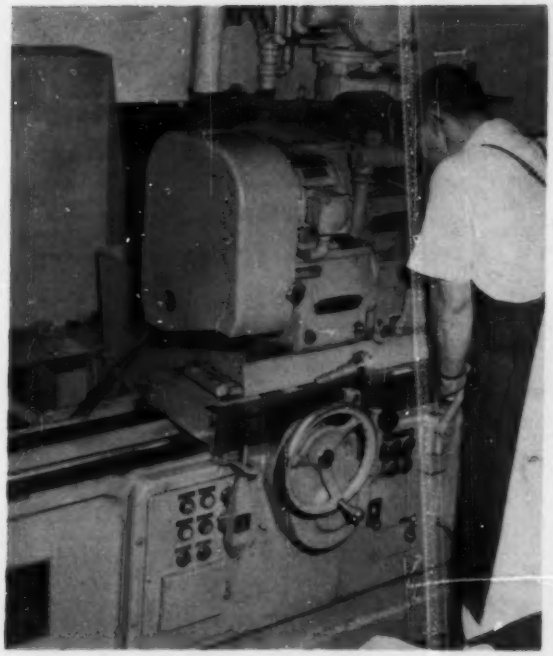
But the most impressive savings were made as a direct result of $250,000 spent on tools, machines, and inspection equipment. Included are automatic grinders, planers, millers, gear grinders, and comparators.

The new equipment holds critical tolerances more easily. Parts are more readily interchanged, and hand fitting and selective assembly have been almost eliminated. The new production equipment also reduced costs and speeded production of other products; sales of hand-operated, semi-automatic, and fully automatic tape-controlled turret drills were considerably aided during the past lean year because the new equipment permitted immediate delivery almost upon receipt of purchase orders.

Company philosophy, both before and after the new equipment was installed, is based on the answer to this choice—sit tight during slow times and wait, or make things happen. When sales are down and the plant is not running at full capacity, then is the time to take a long, hard look at production facilities. Modernization during a lull takes advantage of frequent lower prices, faster delivery, and better service from suppliers and machine builders.

One or two machines can be purchased without financial problems, but capital investment for a major modernization program is more significant. The buyer must be concerned with the mechanics of financing, and he must display courage, good judgment, and resourcefulness. And long-range planning must be based on accurate information; about the market being served, its growth potential, trends, and its present and future needs. Along with this the planner must have the ability and determination to improve his share of the market. These requirements were met when equipment for the new bench turret drill was purchased.

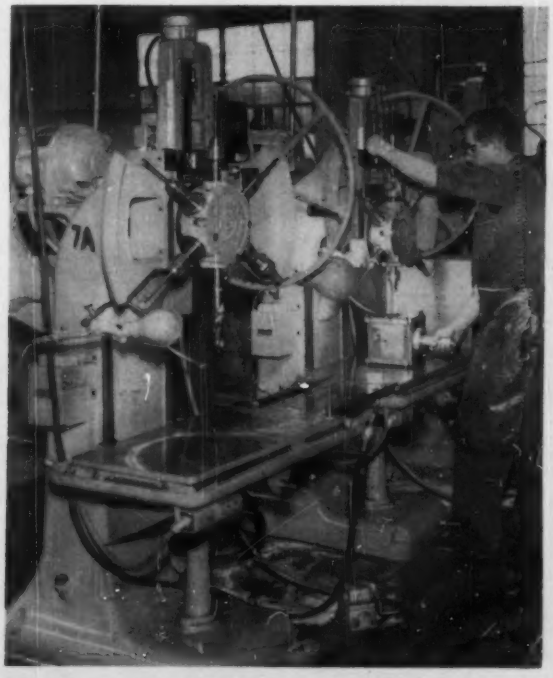
In contrast to many firms, Burg expects to wind up the current fiscal year with sales about 10% ahead of last year.



External grinder repeats within 0.0002 in. on spindle, clutch, locating pins and bushings, crankshaft, and Geneva wheel for new bench turret drill. This Norton grinder also saves time

Milling time is cut in half on a Kent-Owens automatic hydraulic machine where one part can be milled while an operator loads another on the table

Internal grinder boosts speed on parts that used to be farmed out—Geneva dial, camshaft, and locating-pin bushings



Two Burgmaster 6-spindle turret drills do 16 operations on bench-model toolslide. Undercuts are made with self-opening tools; and drilling, tapping, spotfacing, reaming, and counterboring are done. Box jig holds work while four sides are machined at 4/hr

High removal rate, close control stir interest in Japanese spark machine

With a major automobile manufacturer talking of spending many millions of dollars in the next few years for electrical discharge die-sinking equipment, a new entry from Japan should be a hot contender.

150 in Use in Japan

Ikegai Iron Works, said to be the oldest machine-tool manufacturer in Japan, has about 150 of its electrical discharge machines in use in Japan. Recently it set up a company to handle export sales in North America. Called American Japax (pronounced jay-pax) Co, Inc, the company was formed by Dr D L Curtis, Ikegai, and C T Takahashi & Co. Dr Curtis is president and headquarters are at Boeing Field, Seattle, Washington.

Boeing Buys One

The first machine, a small Model D-103, has been sold to the Boeing Airplane Co and delivery is expected before the end of the year. A larger model may be purchased next year. Boeing engineers seem highly pleased with the results they have obtained in tests on a D-103 machine provided for demonstration at the Japax shop. They will, however, only go so far as to say that all factors considered, Japax was the best buy for the money; that it seems to match the manufacturer's claim.

Air Force Interested

In Dayton, Ohio, a spokesman for the Manufacturing Methods Branch of the USAF's Air Materiel Command said that they are extremely interested in the high metal removal rate and surface quality claimed for the Ikegai machines. A study of the equipment is in progress.

What are these claims? Japax people *claim* their machine is at least two years ahead of any machine on the US market. Operating on a principle entirely different from Elox (a major American manufacturer), present equipment is said to remove six grams of material per minute with an average 125 micro-inch rms finish. A more highly developed machine, now being built, is expected to remove up to 50 grams per minute, or 6.6 pounds per hour.

Spectacular Metal Removal

If the latter expectation proves true, this machine will have from 25 to 50 *times* the productivity of any electrical discharge machine now on the market. It would be competitive with the Elox Electro-Chemical Machining equipment which is said to have 20 to 30 times the removal rate of electrical-discharge machines.

"Impulse Generator"

Basis for the Japax claim is the development of an "impulse generator" by the machine's inventor, Dr K Inouye. The circuit within the machine was originally designed, in 1946, by two Russians who received the Stalinist prize as a result. But they were unable to complete the circuit to achieve the precise functions available in the present machine. Dr Inouye picked up the design at that point and developed a servo-mechanism to permit a fine finish at a fast removal rate.

Now, through Dr Inouye's efforts, a different design of circuit is being added. It is this circuit that sharply increases the removal rate. Electric power consumed on the standard machine is 3 kva; the D-500 model can use a 10 kva impulse generator. Present frequencies range from 2000 to 1,000,000 cycles per second.

The Russians asked to purchase 10 of these machines but were refused. Prices in the US, landed at any US port duty paid, range from $17,500 for the D-103 model to $42,500 for the model D-500.

Goal: U S Market

For Ikegai Iron Works, this will be the biggest effort yet to reach the American Market. For Japan, this machine represents the early stage of a new kind of export, designed for industrial rather than consumer markets and produced to a quality standard aimed at competing with the best equipment available. Electrical components and circuits conform to NMTBA "Machine Tool Electrical Standards." Hydraulic equipment conforms to Joint Industry Conference standards.

90 foot candles light diesel-engine shops

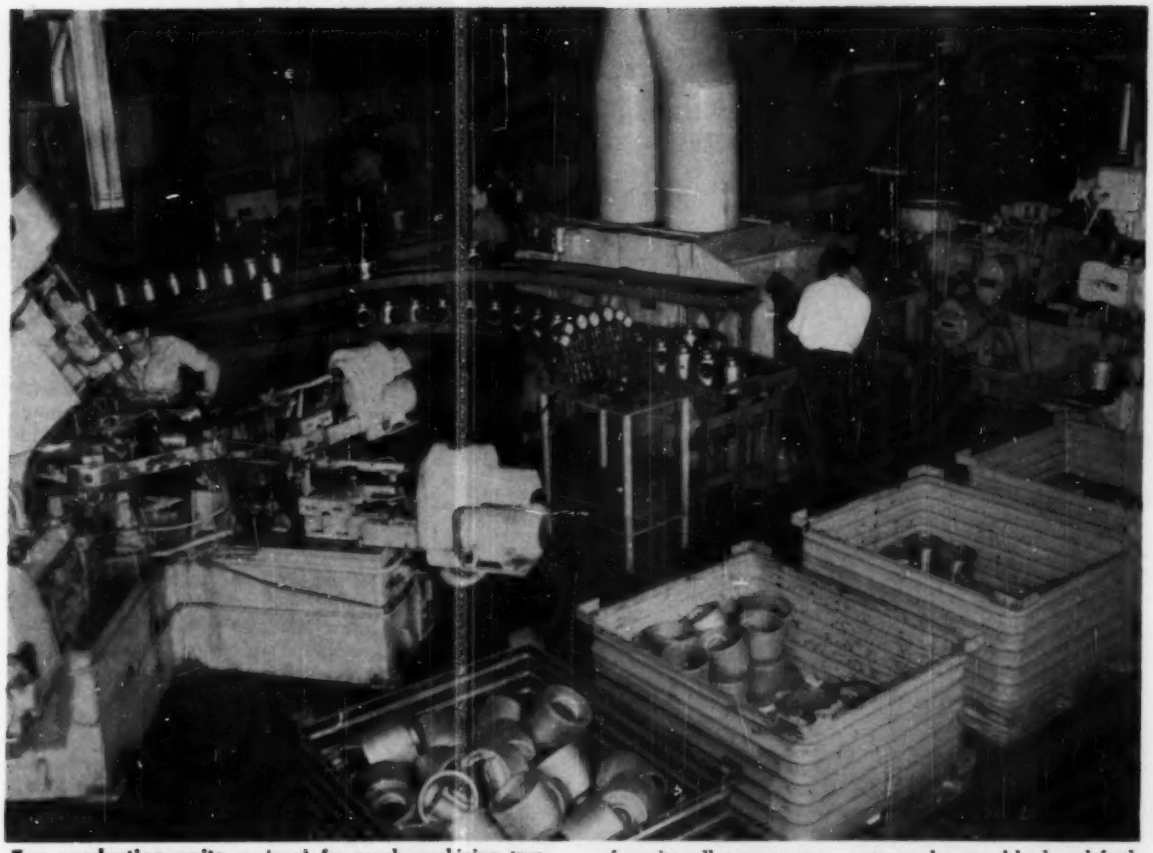
Modernization at Southern Railway's Chattanooga shops includes new lighting facilities that banish the dingy atmosphere of coal-burning days. The railroad wanted at least 50 fc (footcandles) of general illumination and wanted the installation to conform to the Certified Lighting program. New fixtures produced by Terrell Electric provide an average of 90 fc at floor level to more than meet requirements.

Reflector lamps are mounted in groups of four on 20-ft centers, with each reflector lamp and its 22-in. porcelain reflector tilted slightly to throw light centers on the floor on 10-ft centerdistances. The lamps throw 2/3 of the light down into useful areas, while the reflectors control the remaining light to reduce shadows to a minimum.

Supplementary lights are provided along the walls to switch on, via photocell control, in case of power failure. These are necessary because the mercury-arc lamps require several minutes to relight after being cut off.

The Certified Lighting standards met in this installation are part of the National Lighting Bureau's program for industrial illumination. This recommends 50 fc for rough and general work, 100 fc for medium bench and machine work, 500 fc for fine work, and 1000 fc for extra precise machine work such as finish grinding. The last two categories take into account supplementary local lighting that brings up the level of illumination from the general-lighting level in the shop.

Lamps in the RR shop are cleaned and maintained by overhead crane.



Ten production units employed for rough machining trunnion piston carriers for diesel engines are grouped around series of gravity roller conveyors so parts can be moved back and forth as operations are performed "out-of-sequence"

Out-of-sequence machining improves line efficiency

By Warren F Hrstka, chief, Standards and Methods Engineering, Electro-Motive Div, General Motors Corp, La Grange, Ill

By scrapping the tradition that progressive machining must proceed in a straight line in numerical order of operations, line balance is greatly improved and operator waiting time reduced to a minimum

Progressive machining and assembly lines, backbone of low-cost production where standard products are made on a repetitive basis, often operate at inefficient levels because one or more operations are out of balance with preceding or succeeding ones.

The ideal situation is to arrange each line so an equal amount of work is done at each station, thus eliminating output and workload inequalities.

This is not always possible because of quality, processing and machining requirements. So the production rate of the slowest operation determines the line output, and efficiency is low at the other stations.

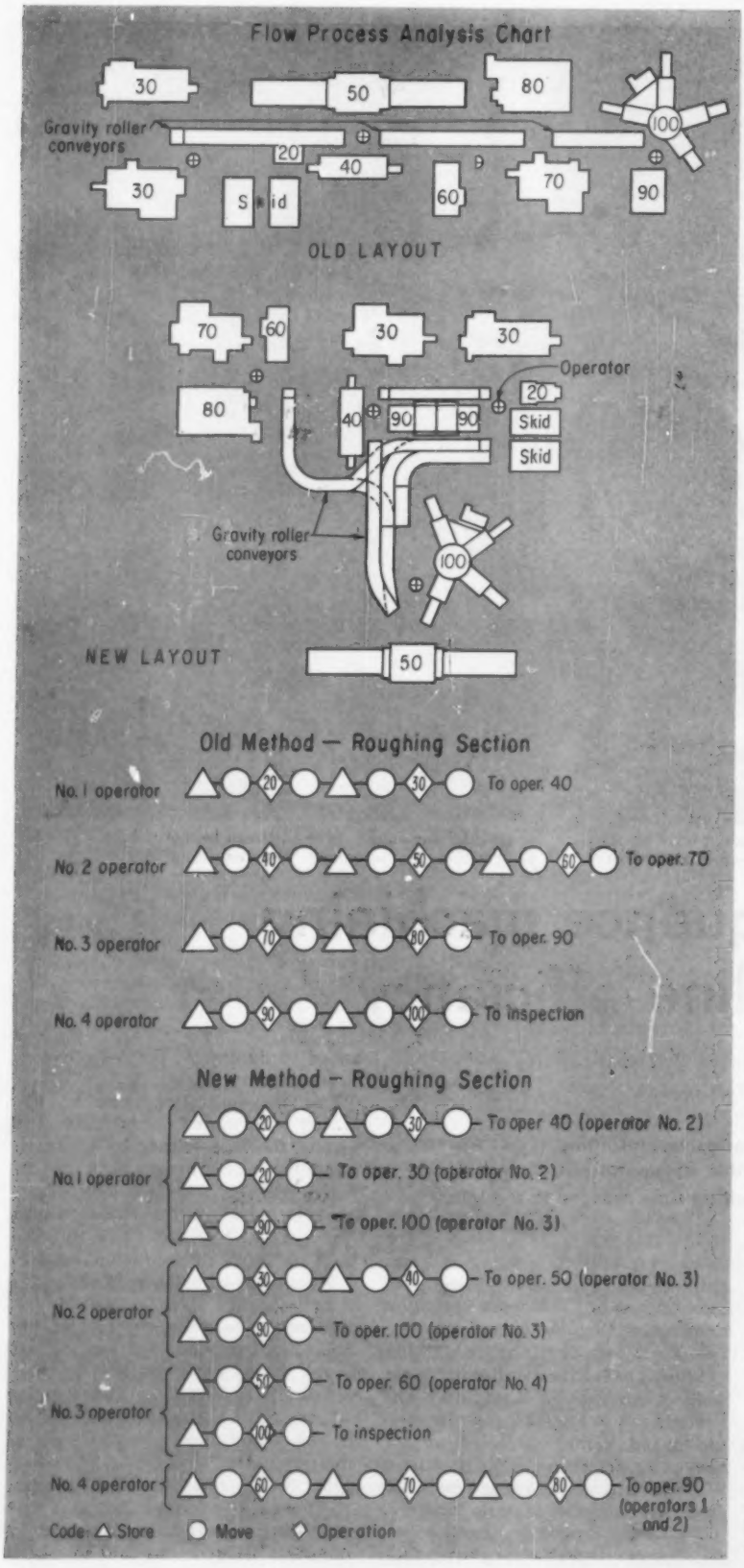
When production requirements are high, progressive lines may be brought into closer balance by providing additional facilities at the slower work stations. But additions of machining units may not be justified by the number of parts involved.

Two methods are frequently used to improve the efficiency of unbalanced progressive lines—both are expensive:

The slower stations can be operated for more hours than the rest of the line—either by allowing a few hours of overtime each day or, when there is sufficient out-of-balance, by running them on a second shift. A bank of parts can thus be built up ahead of the faster stations.

Where out-of-balance is not sufficient to justify operating the slower stations longer than the rest of the line, line-balance time can be allowed at the faster stations to compensate for delays caused by the slower units. This practice solves nothing—and increases the cost of the product.

Many out-of-balance problems can be charged to the false concepts that (1) the lines must be arranged in the same sequence as that in which



Conventional progressive layout (top) of roughing group in line was badly out of balance (see flow-process analysis chart) and production schedules could not be maintained. Rearrangement (below), with operations combined to improve workload balance for the four operators, resulted in major savings and better working conditions

the operations are performed to minimize the distance between moves, and (2) production workers along progressive lines should be responsible only for operations within their skill classifications.

At Electro-Motive, we have taken a different approach by rearranging and changing work assignments to bring individual work loads, and the lines themselves, into better balance.

To do this, work stations have been assigned a number of operations out of their normal sequence, even assigning half an operation to one operator and the balance to another. In a number of cases, the same workpieces may be routed to an operator two or three times, following intervening stops at other stations.

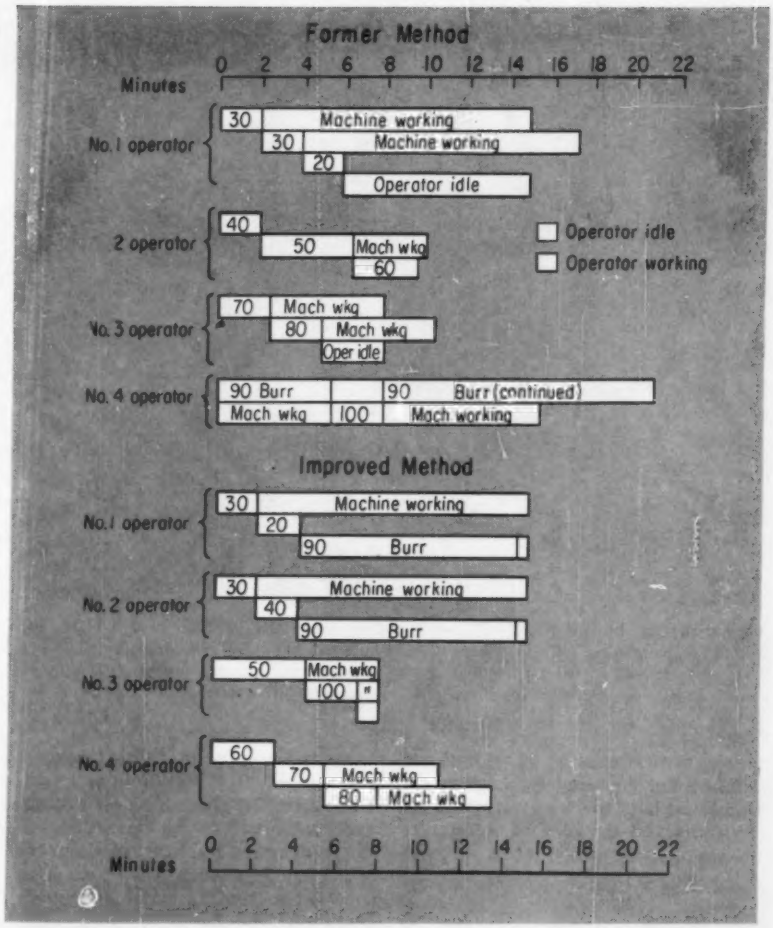
With overhead and gravity roller conveyors, it is not difficult to route workpieces back and forth within a work area—whether succeeding operations are adjacent or scattered. So, except that all the equipment used by each individual operator must be located to provide a convenient work area, machine location makes little difference.

What is important is the reduction of operator waiting time, elimination of line-balance time allowances, and the major reductions in standard hours per workpiece these rearrangements make possible.

In one case we reduced total time allowed per part in a work area by more than 65%. In another we removed four machine tools from the line, eliminated line-balance time allowances, and made sufficient savings to pay for the rearrangement within a year.

An outstanding example of what can be done in rearranging operator workloads to improve line balance is the new layout for the roughing section of the line we set up to machine trunnion piston carriers. Nine

Division of workload among the four operators with the old and the new layouts is indicated by these process charts. Except for Operation 30, where two automatic lathes are used, only one machine is required for each operation



Man-machine charts for old and new layouts show how line balance has been improved, even though all waiting time has not been eliminated. Unbalanced conditions are absorbed by assigning operators to other jobs further along the line

operations are performed in this section (see Table 1).

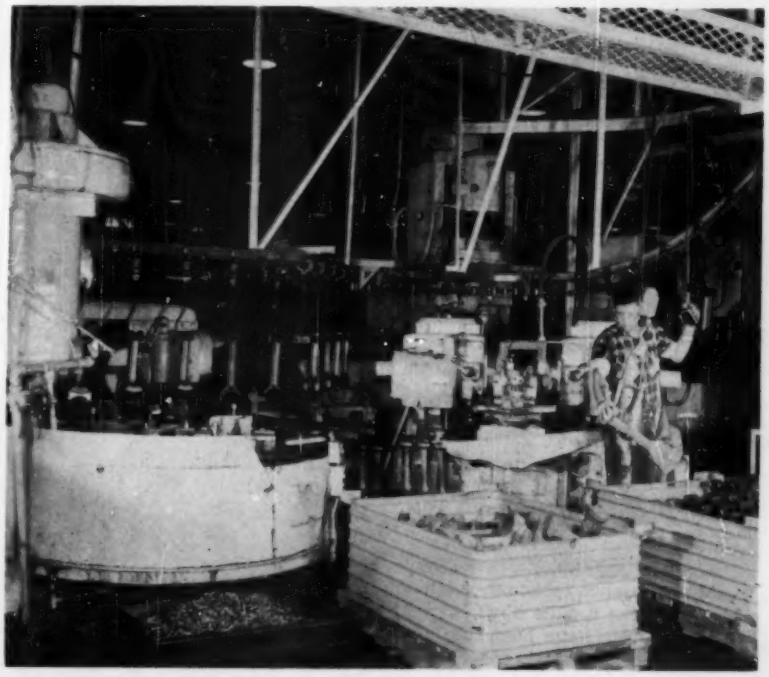
The original layout had the 10 machines aligned along both sides of a series of three roller conveyors placed end to end. Operations 20 and 30 were performed by one operator; the second operator did operations 40, 50 and 60; the third did operations 70 and 80; and the fourth performed operations 90 and 100. Because operation 90 (deburring) required so much time, it was the bottleneck operation (see flow-process analysis chart), when all other operations were under control.

However, when the line was first put into operation, there was considerable difficulty with operation 30. Some of the tools on the two automatic lathes used to rough turn and face the OD, skirt, and thrust face of the carrier did not work as well as expected, and there was excessive down-time for tool changes. In addition, when several tools had to be changed at the same time on one lathe, the other would complete its cycle and shut down, causing a loss of production.

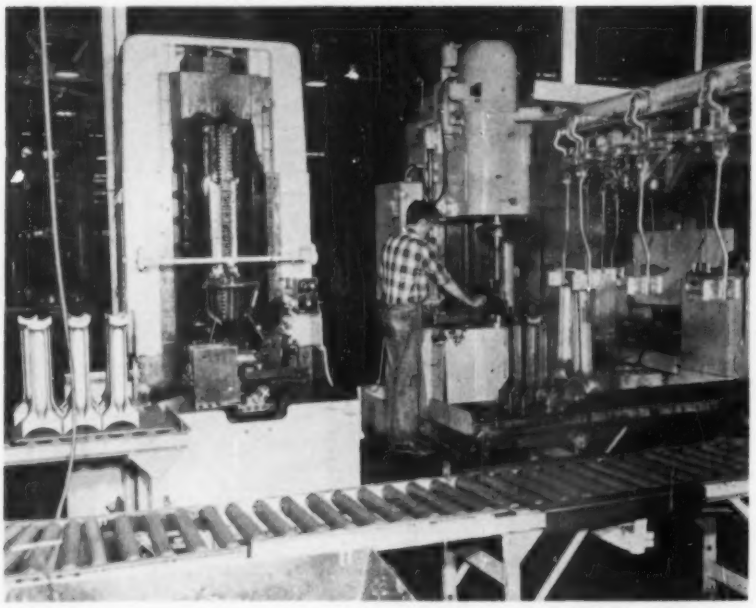
As a result, it was usually necessary to run these lathes on the second shift to maintain production schedules. It would have been possible, of course, to allow for machine down-time in the rate for this operation, and add another machine to help bring the line into balance. But we did not want to go to this expense if another solution could be found.

We decided to restudy the roughing line to see if operation 30 could be divided and combined with other operations. We agreed that if the lathes could be separated, tool changes made on one lathe should not affect the efficiency of the second, which would be run by another operator.

While trying to overcome the diffi-



Out-of-sequence milling operations on connecting rods are performed on adjacent machines. Operator uses hoist to move rough forgings to and from large index miller at left, which cuts slot in fork end. Overhead conveyor with color-coded hangers moves rough-machined rods to and from small duplex miller (center) for semi-finishing sides of fork



Operator on connecting rod line alternately runs vertical surface broach (left) and column-type drillpress (right) converted for piloted hollow-milling operations. Forked rods move to and from broach on roller conveyors, blade-type rods are carried on color-coded hangers of overhead chain conveyor to and from the hollow-milling operation

Table 1

Oper No.	*Operation and Machine*
20	Drill center hole. Single-spindle drillpress.
30	Rough turn and face OD, pilot, skirt and thrust face. Two automatic lathes.
40	Drill two locating holes 180° apart. Spec 2-sp drilling machine.
50	Rough, semi-finish and finish bore two pin holes. Spec trunnion-type drilling and boring machine.
60	Drill boss. Single-spindle drillpress.
70	Semi-finish turn OD and chamfer. Automatic lathe.
80	Semi-finish thrust face and pilot diameter. Automatic lathe.
90	Hand deburr with portable power tools on spec table with suction exhaust. Two operator positions on new divided table.
100	Drill five small holes. Spec 5-sp drilling machine.

culties with operation 30 and, at the same time, looking for a way to break the bottleneck at operation 90, we conceived the idea of combining operations out of sequence so as to use each operator's time as fully as possible.

In the new arrangement, four operators are still required. But their workloads are considerably different, with a resultant increase in output.

The first operator center drills all the carriers (operation 20), sending half of them to the second operator via gravity roller conveyor. The other half he machines on one of the automatic lathes (operation 30) and has time for half of the deburring (operation 90).

The second man operates the other lathe (operation 30), drills two locating holes (operation 40), and deburrs the rest of the parts (operation 90) not done by the first man.

The third operator performs operations 50 and 100, complete, while the fourth man takes care of operations 60, 70 and 80, complete.

After operation 100, parts are loaded on a lift platform for movement by industrial truck to the inspection department.

The roughing line still is not completely in balance (see man-machine chart), but the results have been so outstanding we have been applying the same principles when surveying other progressive machining lines.

As an example of what can be accomplished by combining operations, the elements for two operations on our connecting rod line are given below, together with the remaining elements when these two operations were combined:

Old Method:

Operation A—1 Operator

Operation Element	*Min*
Wait	0.9
Deburr finished piece	0.5
Get new piece, load, tighten	0.5
Clean off chips	0.5
Loosen piece, unload, dispose	0.4
Total allowed time	2.8

Operation B—1 Operator

Operation Element	*Min*
Wait	0.1
Remove backfacing tools	0.3
Wait	0.2
Install backfacing tools	0.3
Wait	2.1
Loosen piece, dispose, get new piece, load, tighten	0.5
Total allowed time	3.5

New Method:

Operation A and B Combined —1 Operator

Operation Element	*Min*
Wait	0.1
Oper B—Remove backfacing tools	0.3

Standard operation sequence for rough machining trunnion piston carrier

Wait	0.2
Oper B—Install backfacing tools	0.3
Oper A—Deburr finished piece	0.5
Oper—Get new piece, load, tighten	0.5
Oper A—Clean off chips	0.5
Oper A—Loosen piece, unload, dispose	0.4
Oper B—Loosen piece, dispose, get new piece, load, tighten	0.5
Total allowed time	3.3

Note that the total time for the new combined operation (3.3 min) is 0.2 min less than the former time for Operation *B* alone, the longer of the two original operations. Also, while there was a total waiting time of 0.9 min in Operation *A*, and 2.4 min in Operation *B*, only 0.3 min is necessary in the combined operation.

Too, with proper conveyorization of the workpieces between operations, the location of operations *A* and *B* in the schedule does not affect in any way the ease with which they may be combined. They may be consecutive operations, or may be separated by one or more other operations.

Compression forming controls springback . . .

. . . and puts machining accuracy into sheet-metal aircraft parts. It is applied by Lockheed Aircraft to F-104 Starfighter wing spars, ribs, and stiffeners to eliminate hand checking and straighening and to allow sharper radii that improve strength and reduce flange thickness.

This new technique allows fabricating parts to exact dimensions, with skin panels flatter and more friction-free in flight. Tighter bend radii let riveters work closer to channel webs, which means thinner webs for the same strength. Narrower offset flanges reduce aircraft weight to improve performance.

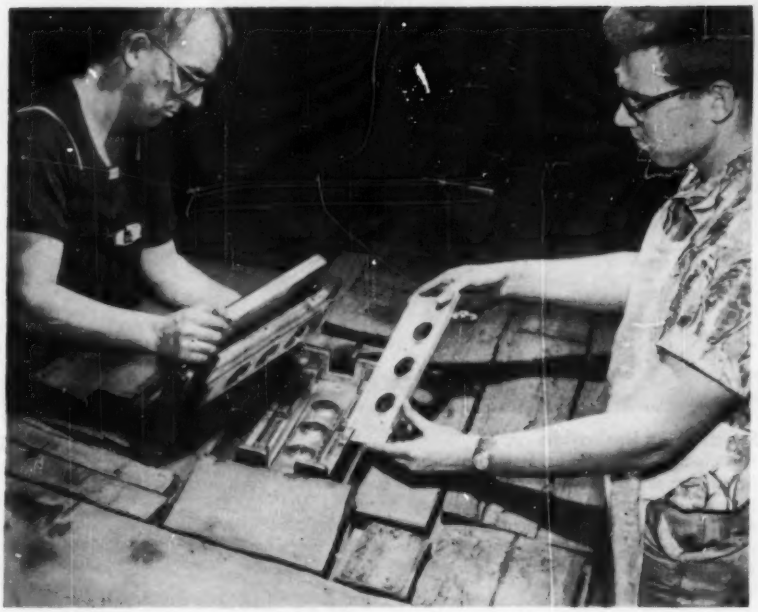
Compression forming starts when aluminum parts are preformed to generous tolerances in conventional hydraulic presses. Guerin (rubber-pad) process works at 1000 psi to shape the metal roughly; then waves in flanges are removed by hand and joggles are defined. Uniform flange widths are machined, then the parts are heat-treated at 925 F for 30 min. Cold-water quench puts the parts into malleable condition.

Now the parts are sized in a compression die, where a rubber-padded punch exerts 1000 psi to spread out the sheet to the die contour. Immediately after, the outer edges of the part are compressed. This two-way squeeze produces a part with predictable springback, for which exact allowance is made in die design. Compression dies are usually made about 0.003 in. undersize of the outside dimension of each part.

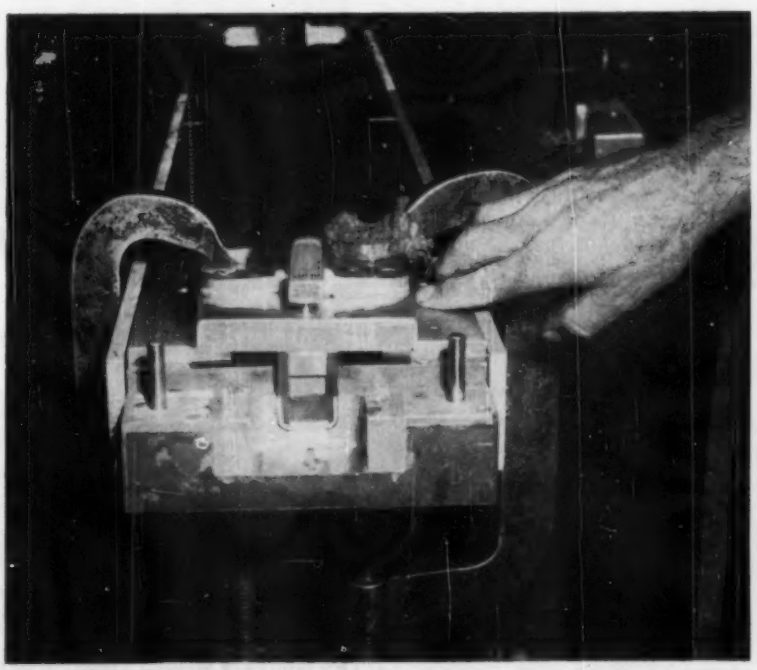
This technique neutralizes the normal forces involved in press forming—the inside surface of the part is compressed and the outside is in tension, while a middle area is still elastic—where the amount of springback cannot be accurately forecast. Compression forming reduces these stresses and makes them more predictable to allow more accurate springback allowances.

After compression forming, the parts are age-hardened to 72,000 psi tensile by heat-treatment at 250 F for 24 hr.

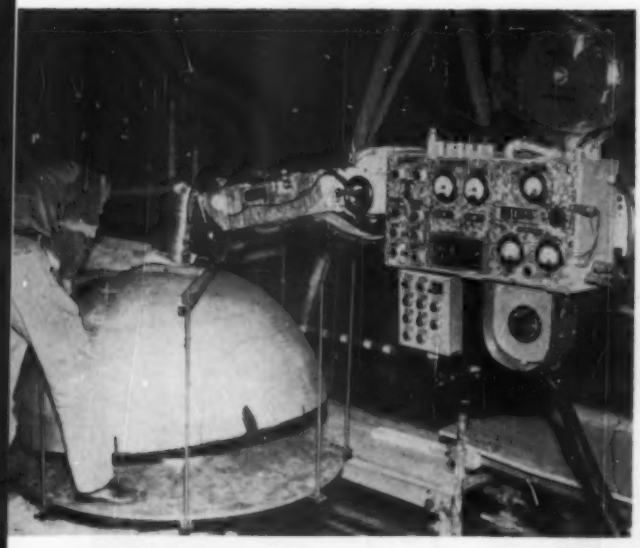
Closer tolerances on dimensions of sheet-metal parts reduces surface defects, which can cost several miles per hour each in the finished aircraft or missile. This is of great importance on the F-104, which must withstand high stresses and high temperatures in flight.



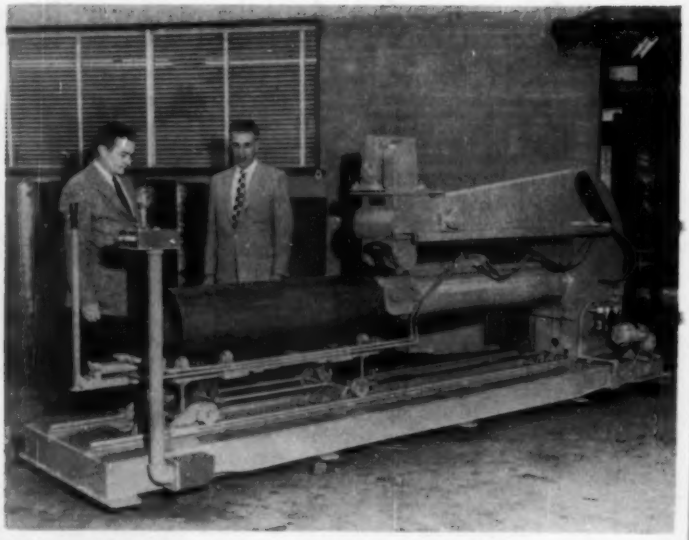
Two-way squeeze . . .
is applied to channel-shaped wing stiffener by a compression forming die. The roughly preformed part is under 1000 psi pressure, which moves the metal out to fit the die. Exact allowance for springback is calculated in die dimensions



Epoxy-resin plastic die . . .
and rubber are used to compression form this V-shaped aluminum aircraft part. Dies for various structural sheet-metal parts at Lockheed range up to 96 in. long by 5 in. wide and 4 in. deep



Shape is no limitation . . .
for this universal welding machine. Part is positioned and rotated by circular table. Welding head is attached to knee-action manipulator on the end of a long ram which can be moved longitudinally and vertically. The equipment handles regular or irregular shapes of any metal in thicknesses from 0.003 to ½ in., can even weld a 54-in.-dia sphere from the inside, through ports

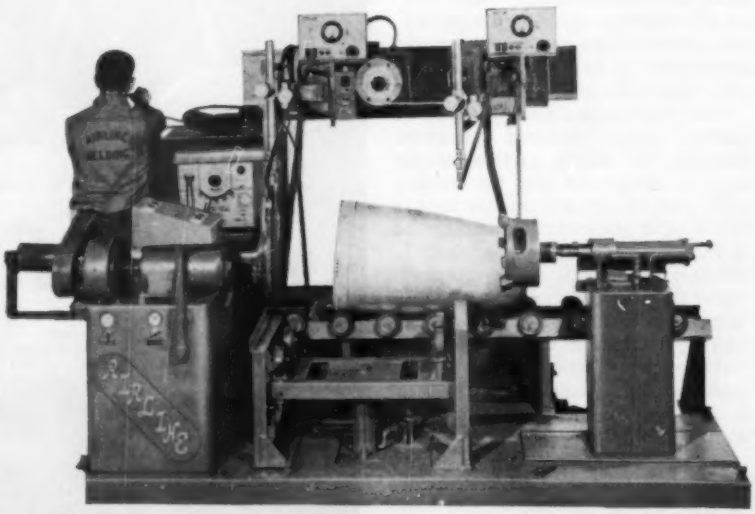


Roll planisher improves mechanical properties . . .
by cold working the weld joint and at the same time smoothing and flattening it to match parent metal. Contoured and hardened upper roll is driven by gear motor; lower arm supports idler roll. Process eliminates need for filler wire and improves tensile, fatigue, and yield strengths

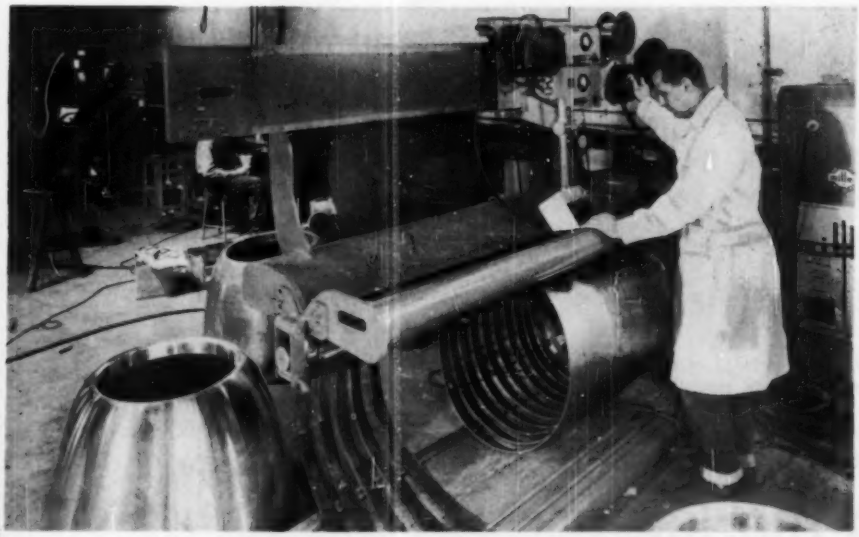
NEW TECHNIQUES

improve sheet-metal welds

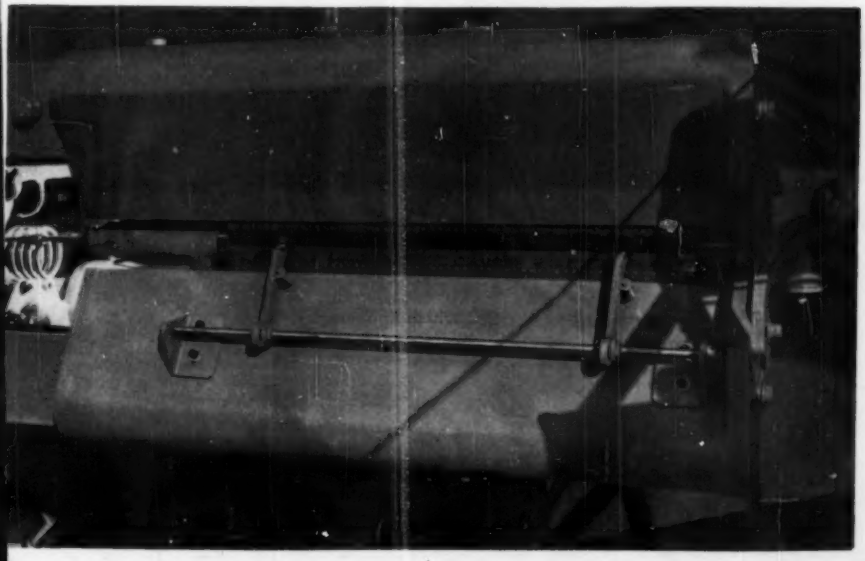
Tolerances on sheet-metal work are getting closer, and the designs are becoming more complex. The trend has been spurred by the demands of the aircraft and missile industry, but there is every indication that it will spread to other fields. Designers are never slow about asking for the best the shop can do. Weld positioners and manipulators such as the ones shown here will help answer some of the problems of precision sheet-metal welding



Two joints are welded simultaneously . . .
on circumferential welding device. Air cylinder raises part into position where it is gripped between faceplate and tailstock. Welding heads are adjustable laterally to suit dimensions of part. During welding operation, the work is rotated at proper speed by adjustable drive unit (left)



Titanium rings are butt welded . . . on longitudinal welding device. Strips in foreground are half-installed for illustration. Normally, one edge to be welded is placed over center groove in backup bar, and the hold-down fingers on that side are actuated pneumatically. Then the process is repeated with the other edge, and the two are forced together. Rigid side-beam track for welding-head carriage and accessory equipment holds deflection within 0.006 in. vertically, 0.003 in. laterally



Level-seeking fingers hold part . . . in this top view of longitudinal welder. Each bank of fingers is actuated individually, presses down and toward the center with a holding force up to 300 lb per lineal in. Spacing between banks is adjustable to suit different metal thicknesses. Thin sheet metals are held by copper fingers and backup bar to conduct heat away from weld and avoid burns, warps, distortion

Mandrel supports copper backup bar . . . in longitudinal welders produced by Airline Welding and Engineering of Hawthorne, Calif. The removable bar draws heat away from welded edges and avoids distortion. It is grooved to fit the desired contour of weld drop-through for uniform bead width

Thin-walled parts . . .
for camera lens are marked during multi-spindle screw-machine cycle that produces the parts. Part at left has been marked only; other parts show excess metal and paint removed to give high-quality finish

DURING SCREW-MACHINE CYCLE . . .

Special stamp marks thin-walled parts

A process for precisely marking thin-walled parts during machining of the parts—not before or after—is currently in use at the Argus Camera Div of Sylvania Electric Products Inc. Part of a multi-spindle screw machine operation, the process roll-stamps exposure opening marks on a circular lens mount while the mount is being machined from aluminum barstock.

When thin-walled components have to be marked, the usual practice is to stamp the design on the part blank before machining, or to engrave it after the part is made. The new process eliminates these secondary operations by combining machining and marking in one high-speed screw machine operation.

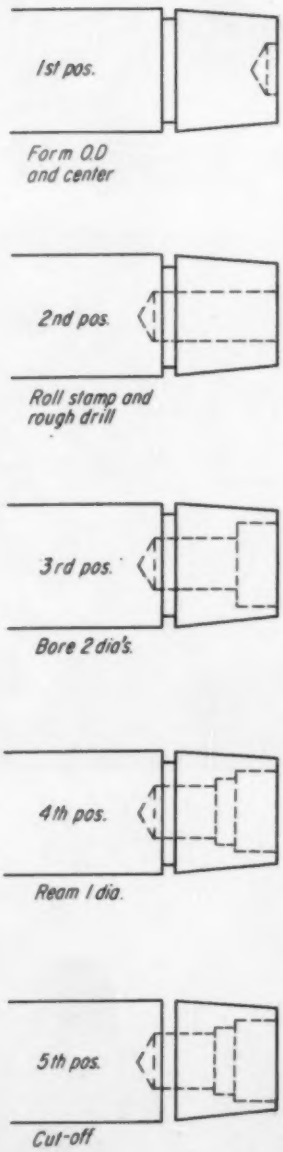
Albert H Bethke, assistant chief tool engineer at Argus, and Richard Norris, chief engineer of New Methods Steel Stamp Co, Detroit, developed the process, which incorporates a roll-stamp attachment at the No. 2 station of a five-station multi-spindle screw machine. Devised originally for stamping exposure-opening markings on the thin-walled lens mount for the Argus C44 camera, the process has been refined and extended to a wide range of similar parts in other products.

OD of the workpiece is formed and stamped early in the machine cycle to prevent the high roll-stamp pressure from crushing or distorting it. At this point the bar has a ¼-in. minimum wall thickness (see sketch). The marking roll is applied to the work at 60 degrees below center, so that most of the roll pressure is placed upon the base of the machine cross slide, preventing the roll from recoiling or backing away from the part. If the roll were on center, the cross-slide operating linkage would not eliminate this recoil.

Built into the roll stamp is a background contact area that gives 0.010-in. depth control and drive (within ± 0.002 in.). This background or contact area must have a lead on and lead off, or start and runoff radial relief.

When the screw machine is operating at full cutting speed with coolant, small vent holes are drilled inside the closed characters on the the stamp (the letters "A" and "O," for instance). These holes overcome pressure built up by oil trapped inside the closed portions of the characters. Allowing trapped oil to escape through the vents eliminates crushing or distorting of the closed characters. If the characters are too small to be vented—as with a 1/16-in.-high closed letter "A"—they are left solid on the roll.

Letters and graduation marks are stamped 0.010 in. deep and filled with paint after the stamping operation. Later excess paint and metal are removed to produce a high-quality finish. Because the stamping operation is part of a multi-spindle screw-machine cycle, the other screw-machine operations are being completed simultaneously with the marking and finishing.



Machining cycle . . .
on multi-spindle screw machine consists of five operations. Design is stamped on part at the second position, when work has a wall thickness of at least ¼ in.

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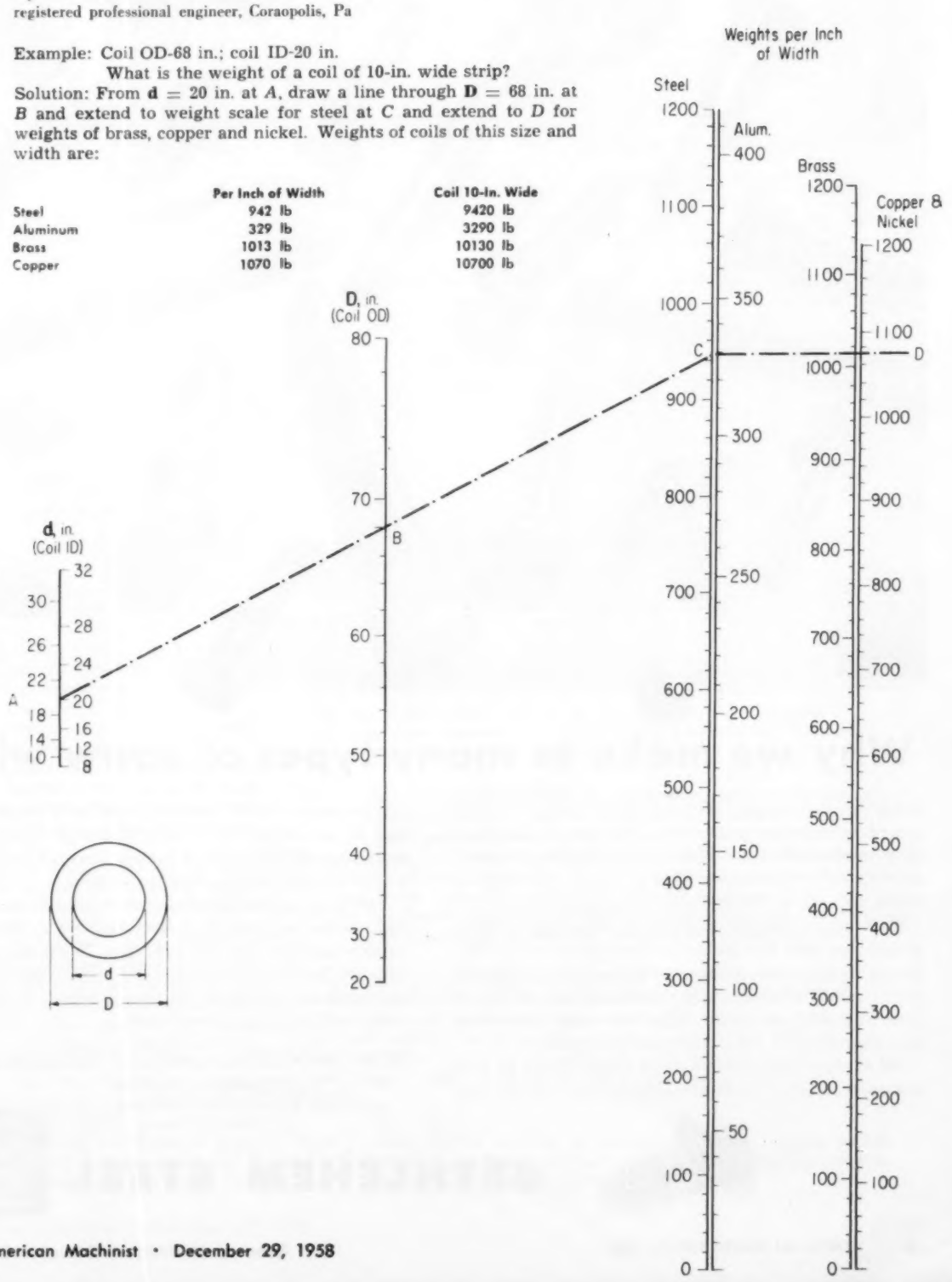
REFERENCE BOOK SHEET

Strip-Coil Weight (Per inch of width)

By Michael M Lachowski,
registered professional engineer, Coraopolis, Pa

Example: Coil OD-68 in.; coil ID-20 in.
What is the weight of a coil of 10-in. wide strip?
Solution: From **d** = 20 in. at *A*, draw a line through **D** = 68 in. at *B* and extend to weight scale for steel at *C* and extend to *D* for weights of brass, copper and nickel. Weights of coils of this size and width are:

	Per Inch of Width	Coil 10-In. Wide
Steel	942 lb	9420 lb
Aluminum	329 lb	3290 lb
Brass	1013 lb	10130 lb
Copper	1070 lb	10700 lb



Why we make so many types of screw wire

Bethlehem makes many different types of screw wire to suit each of the major groups of screws—wood, machine and tapping (sheet-metal)—which face different job requirements. And each of the many types of heads—round, flat, recessed, filister, etc.—poses different manufacturing problems.

Thus the ideal wire for a given type of fastener will differ in some way from wire made for other kinds of screws. Producing the right kind of screw wire for each specific requirement is a Bethlehem specialty. Some of this wire must have good machining properties. Some must readily respond to heat-treatment—or withstand severe cold-heading.

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Talking Shop...

Move the Scrap!

IN A MIDWESTERN city there is a large and rambling plant where they turn out a truck with a respectable reputation for toughness. The plant, however, is mostly a collection of old buildings clustering around a sloping yard. This yard is centrally located and seems a logical place to collect the chips. It was easy to wheel them out and dump them. Over the years the oil ran down the slope and the wheels would carry a little of the oil and a few stray chips back into the building. Gradually quite a layer of "gunk" built up on the plant aisles.

Then came a driving spirit who wanted to move the salvage yard from this convenient, central location. The outcry from the cooler heads can be imagined. The battle raged in the higher echelons but finally the salvage yard was moved to an obscure corner of the property near a siding. At the same time it was redesigned so that shop carts could be picked up and dumped without actually entering the yard. Then they scraped down the plant floors and everybody found it safe to walk on the living-room rug when he got home.

Quite a transformation is being worked in this plant as both equipment and methods are modernized. But the production man who has been one of the driving forces behind this modernization seems proudest of the fact that he moved the scrap out of the middle of the plant.

Maybe it is because that small event represented a turning point in thinking—everybody began to *care* a little more. And have you stopped to think how often you can sense the efficiency of a plant, when you first walk into it, by the degree of pride that everyone takes in the way it looks? A good plant can rarely look like a showcase and be worked in, but it can't be an overgrown junkyard either.

New Calendar

THIS FINE NEW calendar has been designed by an engineering firm in Canada:

Neg	Fri	Fri	Thu	Wed	Tue	Mon
8	7	6	5	4	3	2
16	15	14	13	12	11	9
23	22	21	20	19	18	17
31	30	29	28	27	26	24
38	37	36	35	34	33	32

Note the advantages. There are two Fridays in every week. Such bothersome and unproductive days as Saturday and Sunday are gone. To take care of the man who wants it yesterday, a job ordered on the 7th can be out of the shop by the 3rd.

There are an added seven days every month to take care of all the jobs you have to finish before the end of the month. The first of the month (when the bills come due) has been eliminated, as have the standard invoice dates of the 10th and 25th.

A new day has been added, Negotiation Day, which can be devoted to requests for improved delivery. This calendar has impressive possibilities and we hope the Canadian manufacturers will give it a try and work out any small bugs that remain.

Commuting Cleaner

AT THE GREENVILLE, S C, plant of Hartford Screw Co a portable coolant clarifier is serving a number of grinders. The cleaner is on casters and is moved down the line to clean the coolant in each machine successively. The unit, built by De Laval Separator Co, has a capacity of 14 gpm and is reported to be saving $200 a month in coolant costs.

MEMOS

by BESS RITTER

"Goldbricking" relates directly to the usage (and misusage) of metal: The place was our own United States, and the time was the fairly-recent post-Civil War period, when getting rich was easy (theoretically speaking) if a man went West and claimed himself a gold mine.

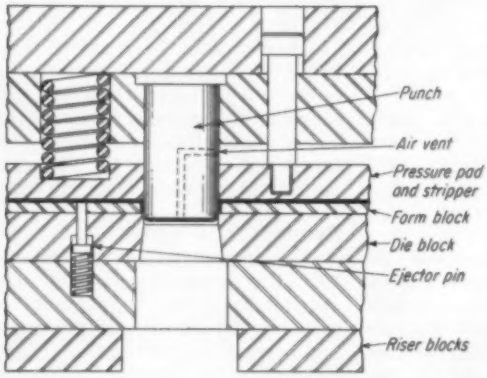
An even easier method, as practiced by some swindlers, consisted of taking a brick of iron, coating it with a thin layer of gold, and telling some poor unsuspecting soul that it was pure gold, through and through, which had been stolen from a California prospector. "Because I want to get rid of it in a hurry," was the usual spiel, "I'll let you have it for next to nothing." Then prices which ran into three and four figures were seriously quoted and even more seriously accepted.

This seems to be too simple a scheme to take in any but the extremely gullible, yet it was practiced so successfully so frequently that "gold brick" entered the American language as a synonym for the phrase "to swindle." And some of these swindles were pretty grandiose, with only one example of this being a gold-coated brick which sold for no less than $3,700.

Later on the meaning of the phrase was enlarged to include any scheme that was clever enough to shortcut the performing of an honest day's work.

Practical Ideas...

Punch Draws Flange and Punches Hole With One Stroke



Some of the products of our shop often require holes and notches with extruded flanges. These are made for the purpose of receiving other parts which are joined by either automatic brazing or soldering.

The generally accepted method of producing the flanges is to first punch the hole, then, in a second operation, draw the flange. However, this procedure has some disadvantages unless conditions are ideal. Cracks and tears easily develop, making a good brazing or soldering joint impossible. Flange height may also be irregular when locating points for the two operations are not identical.

Both difficulties are eliminated with the die shown. The punch actually swages the flange before the hole is punched. A heavily spring-loaded pressure pad, which also serves as stripper, is largely responsible for the success of this method of producing a flanged hole. It holds the material and prevents it from crimping around the opening.

The height of the flange is controlled by the form block mounted on the face of the die itself. Spring loaded pins are located near the forming area to eject the flange. The size of the radius on the end of the punch is usually the same as the thickness of the material. A small vent hole in the punch prevents suction when it is withdrawn, permitting the slugs to drop through.

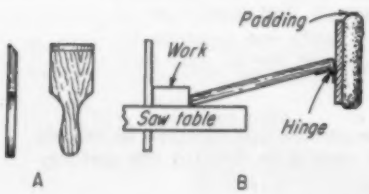
By flanging and pinch trimming in one operation, we eliminate not only extra handling and setup time, but also the chance of misalignment between operations. Because of this, rejects due to cracked or ripped flanges are non-existent.

R Schafer, Racine, Wisconsin

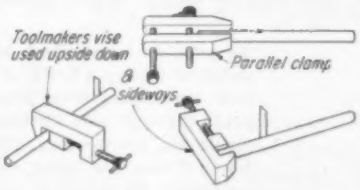
Tips on Bandsaw Operation

The metal-cutting bandsaw has become one of the basic and essential machine tools in recent years. Yet, no other machine is abused as much, apparently because of a general misconception—that anyone can operate a bandsaw without instructions, other than to know where the on-off switch is located. Most of the following tips should be well known to apprentices and journeymen alike, but it may be well to review them and to add some suggestions not usually found in manufacturers manuals.

• Bandsaws are exceedingly dangerous to operate. Fingers should never be used near the cutting area to push the material into the blade. Instead, use a wooden pusher. The simple form A takes only a minute to cut out of a board. The more elaborate type B uses chest pressure and frees both hands for guiding the work. However, excessive pressure should be avoided because this is sure to damage the blades.



• Never try to saw round pieces by hand holding them only. They can be prevented from rotating by gripping them with a vise or parallel clamp. A vise should be used on its side or turned upside down as shown, and tighten securely.



• Best results are obtained when saw manufacturers' cutting speeds are followed. Blades will then cut faster and last longer.

• When a bandsaw is used by more than one man, and for various kinds of material, it should be made a habit by everyone to reduce the speed of the blade if it has been stepped up for cutting soft material. If this isn't done, the next operator can, inadvertently, ruin a blade.

• It is a good policy to reserve new blades of all widths for jobs requiring utmost accuracy, and to use older blades for rougher work.

• Make sure, when selecting a blade, that the teeth spacings are no wider than the thickness of the piece to be sawed, particularly if the material is metal. This is sometimes overlooked and, as a result, teeth are quickly ripped out.

• When sawing around sharp corners, a lubricant helps to preserve the blade. Paraffin does a good job of it. But if paraffin is not handy, ordinary bar soap can be used as a substitute.

Walter Genstel, Berkeley, Calif

How to Preserve White Lead

If you use white lead out of a can around the shop, here is a way to keep the lead from drying out. Stick a match into the lead, stem down, and light it with another match. As the first match flares up, quickly seal the can with its cover.

The result is that a vacuum is created because of the fire consuming the oxygen. When the can is again opened, the lead will be fresh without the familiar hard-skin surface.

Harry Miller, Sarasota, Fla

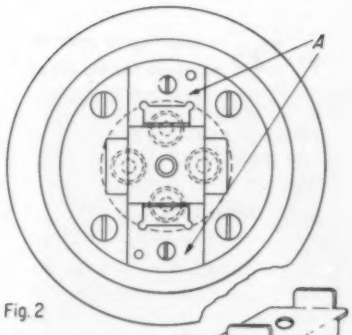


Fig. 2

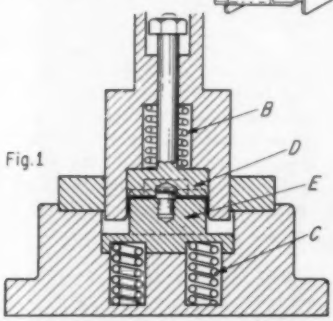


Fig. 1

Double-Acting Bending Die

Tooling was necessary to bend four flaps on a large quantity of sheet metal parts. But, because of the fact that two opposite flaps had to be bent down and the other two up, very simple tooling would not perform satisfactorily. This led to the construction of the die shown which we think is as simple as can be made since it performs both operations at once.

Here is how it works: The blanked parts are nested between two locating plates indicated by A, Fig. 2. As the pressram descends, springs B Fig. 1 compress to start the down bend of two flaps. Thus, spring B is overpowered by the springs C in the die with the result that the ejector D is forced to the bottom of the punch cavity.

The other two flaps are wiped upwards against the sides of the ejector as the punch drops further to depress the four die springs. The instant the press chankshaft hits bottom dead center, the forming pad E contacts the bottom of the die cavity. At this point the bends are spanked home to produce sharp right angles with very little spring back.

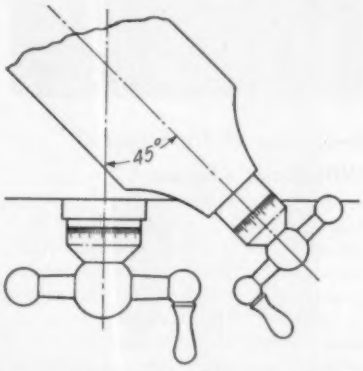
Hjalmar Dahl, Upplands Vasby, Sweden

Turning Accuracy Increased With Compound Feed

Here is a simple trick by which the accuracy of a lathe can be multiplied considerably. Use the compound feed to increase the cut when turning or boring. After checking and finding the indexing graduations on the lathe compound correct, the best workable angle is selected. Any angle will increase the accuracy of the depth of cut, as compared to the cross-slide feed.

The thing for an operator to do when using this method, is to choose an angle most easily calculable. This will reduce chances of errors, and he will be better able to regulate his cut.

The sketch shows the compound



set at 45°. In this setup, one division advancement corresponds to only 0.707 times its normal value, or an increase in accuracy of 1.41. Other values are found in the table below.

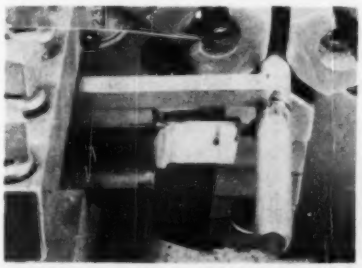
Angle	Reduction factor	Accuracy Increase
60° 00′	0.5	2.0
66° 25′	0.4	2.5
71° 25′	0.333	3.0
78° 28′	0.2	5.0
84° 18′	0.1	10.0
87° 8′	0.05	20.0

Federico Strasser, Santiago, Chile

Top-Drag Bar Dampens Chatter

One of the most annoying and damaging difficulties in machining is chatter. The vibration produced dulls tools faster, sometimes causing jamming and eventual tool breakage.

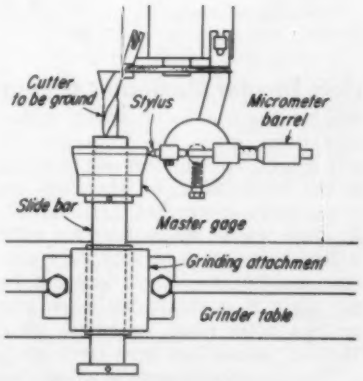
When chatter occurs in cutoff operations, a hardened and ground bar, clamped on top of the cutoff tool, will aid in damping it out. The bar, which can be a standard hardened parallel, is shimmed up to permit it to bear lightly on top of the work.



A slight overhang is necessary so the bar will contact the work before the tool.

The fact that the work is somewhat raised when the tool begins to cut, makes the parallel act as a brace, or hold-down, as the cutting progresses. Cutting oil applied to the work provides sufficient lubrication to prevent excessive friction between the "chatter snubber" and the work.

H J Gerber, assistant prof and head of machine shop dept, Oklahoma State University, Stillwater, Okla



Tool Grinder Employs Form-Grinding Setup

The arrangement shown is used to alter high-helical-flute end mills and to grind shop-made cutters to forms required. The setup includes a master gage, mounted on the slide bar by a setscrew, and a stylus follower with micrometer adjustment. A bracket, attached to the machine

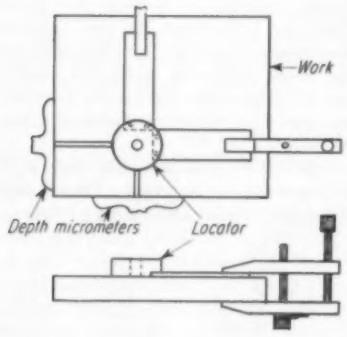
Practical Ideas...

frame supports the stylus head, which can be rotated for angular adjustments.

Master gage and stylus adjustments are made after cutter has been inserted and locked in the slide bar. With a flute resting on the indexing finger, the master and stylus are correlated with the grinder wheel. Once set, any number of cutters can be ground to the angle of the gage.

Free longitudinal movement of the table must be assured to allow the stylus to ride against the master through any reasonable form. The operator can maintain this contact by hand, or a spring may be added to do the same thing. Depth of cut is controlled by the micrometer-stylus setup.

John Greiner, Oceanside, L I, N Y



Hole Locator Eliminates Layout

We use the illustrated device to locate holes when the workpiece is either a bit too cumbersome to bring to the layout table, or when the job is too small to warrant a full layout. In other words, when there are only a few holes to be drilled, this tool does a quick job of hole locating. In die work it is invaluable when one or two holes must be added after the full layout has been completed.

The first requirement is, of course, that two accurate reference edges or hole locations are available from which measurements can be made. A depth micrometer or vernier-depth gage is used to position the locator from these edges. When holes are used as reference points, pins are fitted into them and gage blocks, or some type of measuring rods, are used between the pins and the locator to find its position. Clamps or straps secure the locator to the work.

The main part of the tool is the center disk which is machined to a standardized diameter for easier periphery-to-center calculations. Its concentric hole can be made to accept just one size drill or bored up larger to be fitted with various ID slip bushings. Recesses are milled on the face of the disk, to be used as the underside, to receive two clamping wings. These are either screwed or riveted to the disk.

Howard Levy, Brooklyn, NY

Drillpress Quick-Stopped With Bicycle Brake

A drillpress operator who runs his machine on a production basis will, when making quick drill changes, slow down and stop the machine by grabbing the chuck after the motor is shut off. The braking arrangement shown, not only stops this dangerous practice but saves time between changes by instantly stopping the spindle.

The basic part of the braking equipment is a hand-operated bicycle rim brake. A piece of angle iron carries the brake head and is mounted near the motor pulley with one of the motor-mounting bolts. The flexible shaft couples the brake head to the hand-grip assembly which mounts on an accessory bar close to the motor switch. Thick rubber blocks take the place of the standard brake lining provided with the brake assembly.

A friction plate is also necessary. This is a ⅛ in. round disk bolted to the underside of the motor pulley after it has been trued up in the lathe. The rubber friction blocks contact both sides of this plate as the hand grip is squeezed.

George Robitschek and Jack Johansen, experimental shop, RCA, Los Angeles, Calif

George Kelly
Philadelphia, Penna

won $25 in addition to regular payment for his idea:

DOWELS SUBSTITUTE FOR PUNCHES

In the Oct 6, 1958 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

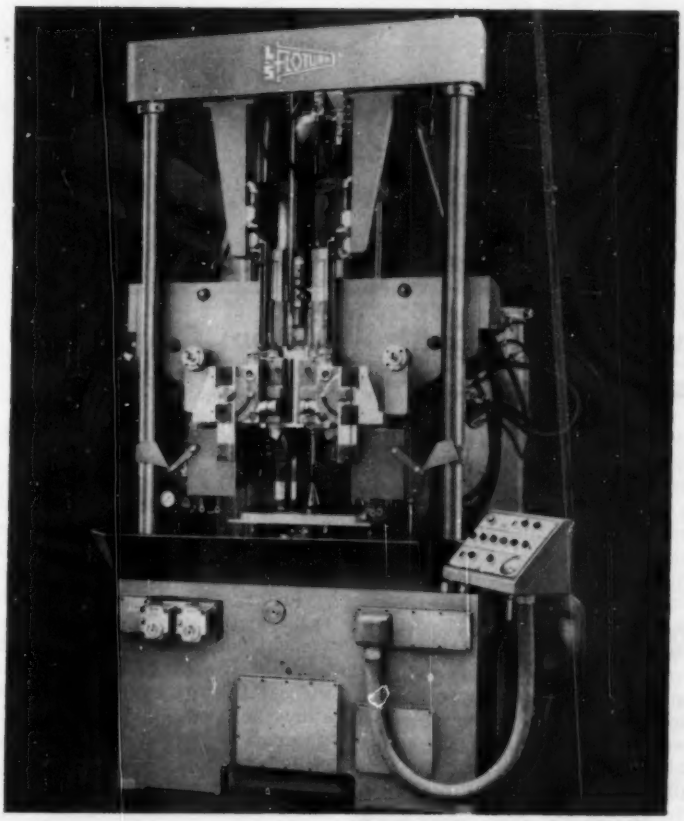
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes **entirely each** time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N. Y.

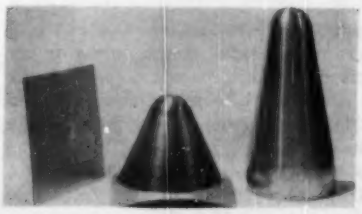
New Shop Equipment
Materials and Parts



Vertical design uses two opposed rollers, virtually eliminates spindle deflection. Prototypes and scale models, as well as production parts, can be machined

Lodge & Shipley Vertical Floturn Lathe Features An Automatic Production Cycle

Designed for lowcost, high production of conical and contoured parts, the No. 12 Vertical Floturn machine features a completely automatic production cycle. The blank is loaded, the starting button pressed, and the part is flowed and stripped from the mandrel automatically. Automatic loading and unloading are easily arranged for most workpieces.



"Explorer" nose cone was produced from flat blank of Type 430 stainless steel; blank thickness 0.094 in.; finished thickness 0.013 in. Cone is 12⅛ in. high, 6 1/6 in. in diameter

The base, or headstock, of the machine contains the spindle and spindle drive, clutch and brake, lubrication reservoirs and pumps, coolant tank and pump, and other equipment. The column, or bed, is another casting, bolted and wayed to the base.

The tailstock carries a built-in live center on a double-acting piston. The carriage has two synchronized and hydraulically actuated roller slides and is moved up and down the column by two hydraulic cylinders.

These tracer - controlled roller slides are mounted on a common carriage to insure complete synchronization of the rollers during the work cycle. By this arrangement it is possible to produce any desired body of revolution—rectilinear, convex, concave or any combination—from templets. Each roller slide has its own hydraulic tracer, templet, templet support, templet adjustments, and pump. The tracer valve has been designed for maximum accuracy and for easy changing of the stylus.

Thickness compensation

Automatic thickness compensation takes into account variations in blank thickness and also variations in tool position due to thermal expansion. This is important in a high production machine. Variations of as little as 0.003 in. in blank thickness can result in unacceptable finished parts if compensation is not made. The compensation takes place through inter-relation of the templet slide and the tailstock.

Capacity

The spindle is arranged to receive mandrels suitable to particular Floturn jobs, which may range up to

12 in. in diameter and 15 in. in length. By utilizing a 2-in. adjustment in each roller slide assembly, the maximum diameter can be increased to 16 in. Specifications include an 18-in. maximum size round blank (12 3/32 in. square); seven spindle speeds from 333 to 1200 rpm; longitudinal feed rates from 0 to 100 ipm, and cross feed rates that are tracer controlled to match the longitudinal feed.

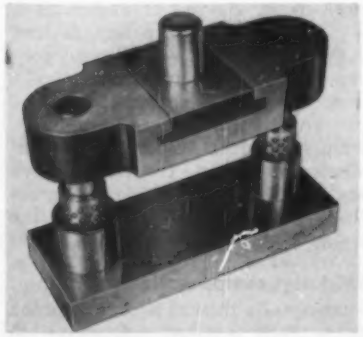
Powered by a 40-hp, constant-speed (1800-rpm) motor, the machine has many other features—among them an automatically operated, combined blank-centering device and finished part stripper; automatic slide and way lubrication; a separate hydraulic unit containing the hydraulic tank, pumps and drive motors for the pumps.

Other advantages

In addition to saving a considerable amount of floor space, the vertical design makes it very easy for the operator to load and unload workpieces. It allows him to get close to the work and follow the progress of the operation, and the convenient height of the work area reduces operator fatigue, thereby increasing efficiency and production.

Lodge & Shipley Co, 3055 Colerain Ave, Cincinnati 25, Ohio

MORE DATA? Circle 51, inside back cover



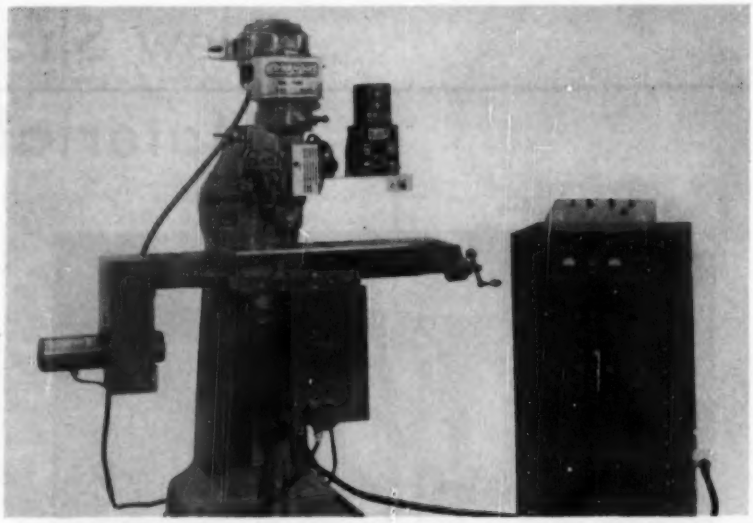
Lempco Die Sets Equipped With Aluminum Retainers

Special alloy aluminum ball bearing retainers are said to add as much as 50%, in some cases, to the life of die sets, in addition to cutting bushing weight in half.

Guide pin bushing is self-aligning, maintains alignment for millions of strokes, according to manufacturer, and requires minimum maintenance.

Lempco Industrial, Inc, Bedford, Ohio

MORE DATA? Circle 52, inside back cover



Lowcost Tape-Control System Combines Discrete and Continuous-Path Control

Known as the Micro-Path control system, this simplified system for machine tool control utilizes a magnetic tape to store a pre-recorded program. It combines both discrete (point-to-point) and continuous-path positioning control, and requires no computer to place the recorded program on the tape (*AM*—Dec 15, p75). By eliminating computer techniques, the necessary auxiliary equipment, and the need for programming personnel, Topp Industries is able to offer this system for $15,000 to $25,000, a cost within the reach of many of the smaller shops.

The system has been designed for addition to existing machinery with only minor modifications, or for use with original equipment. Locating tolerance is reported to ±0.001 in. with a repeatability of 0.0002 in.

Discrete positioning

A positional control is supplied for each controlled axis of the machine. In operation, the operator sets the controlled slides to a reference point with the recording controls inoperative; the accumulating position reader and dial indicator are then zeroed. After switching to record, the operator need only manipulate the control to move each slide to the required position. The pulses generated by the moving slide are recorded on the tape. At the desired position, the operator can program such auxiliary functions as spindle start, quill down, etc. This process is repeated for each successive point in the program, until it is completed.

Continuous path

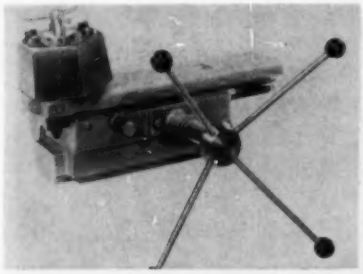
A contour recording stylus permits the operator to exercise simultaneous control over positioning of both axes of the controlled machine. The stylus programmer may be attached to the controlled machine in any convenient manner. It may be attached to the machine column with a drawing or templet attached to the machine table, or it may be attached to the controlled slide with the drawing or templet in a fixed position on a sub-table. Slight pressure on the side of the stylus generates pulses which move the table in the direction of stylus pressure and which record on the magnetic tape. With this system, parts can be machined using rough drawings (with accurate point locations), scribed layouts, simple templets or master parts.

To simplify programming, recording is done at ¼ actual speed. This simplifies the problem of positioning accurately to a point at the highest practical feed. The operator can program "fail-safe" check points as desired to assure correct slide positions.

The control console measures 22 x 22 x 44-in. high. The contour table has a working surface of 14 x 24 in., a longitudinal travel of 20 in., and a transverse travel of 9½ in. Table feed rate is 0-50 ipm.

Micro-Path, Inc, Div of Topp Industries, Inc, 4949 W 104 St, Inglewood, Calif

MORE DATA? Circle 53, inside back cover



Extra-Heavy-Duty Bed Turret Fits Lathes in 13- to 16-in. Range

This A K extra-heavy-duty bed turret is available in two models; one with a straight ram, the other with a tilt head ram (5° angle). It is specially designed to meet demands of the larger size lathes, such as the Cincinnati, Le Blond, Colchester, Monarch, Rivett, and many others in the 13- to 16-in. range.

This self-indexing bed turret, with six-station Meehanite head, converts an engine lathe into a ram-type turret lathe for production work requiring multiple machining operations.

All tool holes are blank, so they can be machined by the user for perfect alignment with the spindle hole.

Precision Processing Co, 3269 Casitas Ave, Los Angeles 39, Calif

MORE DATA? Circle 54, inside back cover

Jones & Lamson Introduces Single-Spindle Fully Automatic Tracing Lathe

Designed for a wide range of specific turning requirements, the Model 30 tracer lathe can accommodate either of two tracing units. One performs a single tracing cut in a fully automatic cycle; the other unit provides two fully automatic tracing cuts with an indexing toolholder. Both units provide for feed change during the cut.

Two headstocks are available. One permits shifts between two speeds; the other allows automatic shifting between four selected speeds. The machine also accommodates a choice of rear slides for facing, forming and turning.

Other machine features include extremely flexible controls which can be programmed from the operator station; positioning of the stylus and templets away from chips and coolant; large unobstructed area for manual or automatic loading and chip disposal.

Specifications include 23-in.-dia swing over rails; 13½-in.-dia swing over tracer slide; workpiece size, ½ in. (min) to 8 in. dia (max); max length of work between centers, 24, 48 or 72 in.

Jones & Lamson Machine Co, Springfield 16, Vt

MORE DATA? Circle 56, inside back cover

Rotary Assembly Machine Has Integrated Pressing Station

This high-speed rotary transfer machine is furnished with an integral pressing station to perform crimping, riveting, staking and forming operations in conjunction with automatic assembly or for dial-fed secondary press functions in the manufacture of small parts.

Called the Type O Pressembler, the machine has a roller gear drive as the indexing mechanism. The drive achieves an accuracy of 0.001 in. and zero backlash, and is rated for a minimum of 8000 hours of operation without maintenance. Capacity of the press station is 14 tons with a 2-in. stroke.

Two models are available, with dial sizes of either 24 or 36 in. and 6, 8, 12 or 16 stations. The Model E, for assembly operations requiring long cycle times and/or variable dwell, has a production rate of 40 pieces per minute. Press station and index table are separately powered. Model M attains production rates up to 150 assemblies per minute. Mechanically timed and synchronized, its dial and press are driven by a single motor.

Ferguson Machine Corp, Roller Gear Div, 7818 Maplewood Industrial Court, St Louis 17, Mo

MORE DATA? Circle 55, inside back cover

Rotating Device Positions Coils For Easier Truck Handling

Palletized metal coils are placed on the bed of floor-mounted rotating device by a Yale K-48 truck with special ram forks hydraulically separated to accommodate the pallet. Truck is backed a short distance to an overhead control pendant that activates the rotator, or upender. Automatic cycling button brings three arms into action that grasp the coil; upender bed rotates forward until coil is in a vertical position. Truck operator closes his forks to form a

single ram, moves forward and picks up the coil with the ram for delivery to a manufacturing operation.

Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna

MORE DATA? Circle 57, inside back cover

Hydraulic Control Valve Permits Remote Flow Control

Directional control valve, designed for the remote control of flow for hydraulic actuation, is a ¼-in. four-way, two-position dual solenoid-operated valve with a flow capacity of 3.5 gpm. Operating presure is 1000 psi. Valve has an iron body and a hard nitralloy stem. It can be mounted horizontally or vertically, and is available in manifold or pipe tap styles; also available in single solenoid type. It is 8⅛ in: long, 2 3/16 in. wide, 4½ in. high.

John S Barnes Corp, 301 S Water St, Rockford, Ill

MORE DATA? Circle 58, inside back cover

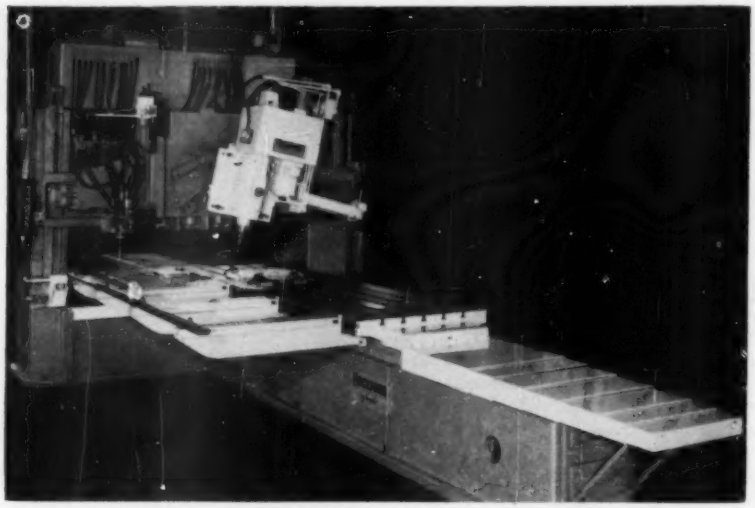
Drillpress Chuck Can be Changed While Machine is Running

The Tri-Mark quick-change drillpress chuck makes it possible for the operator to make live changes instantly with the machine in operation. A smoothly machined finger extension groove enables him to do this without exposing his hands to the drill. Chuck is held in place by friction on the taper. Standard drills are mounted in a machined collet which is drawn upward into a seating position on the drill spindle, and is positively retained on a tapered seat.

Collets are furnished for a complete range of fractional, letter, and wire sizes up to ½ in. Blank collets are also available.

Pacific Tool & Mfg Co, 7912 SE Powell Blvd, Portland 6, Ore

MORE DATA? Circle 59, inside back cover



3-D Swarfing Mill Machines Joining Edges of Compound-Surface Parts

The Rockford Hy-draulic 3-D swarfing mill machines the joining edges of aircraft or missile parts or subassemblies having compound surfaces. (Swarfing is the term used to describe warp or twist milling of the edges to assure accurately mating surfaces.) The swarfing head consists of a slide with square-sectioned arc ways, bolted to the face of the duplicator slide. A swarfing saddle is moved on these ways by a trunnion-mounted cylinder. An electronic single-axis tracer mounts on adjustable slides on the left-hand column.

The tracer stylus is positioned by a thin templet, and converts the mechanical information received from the templet to an electrical command signal. This electrical energy is used to position an electro-hydraulic servo-valve which controls the flow of oil to the cylinders. A second electronic tracer, located on the swarfing saddle, feeds back information for correction of angular position.

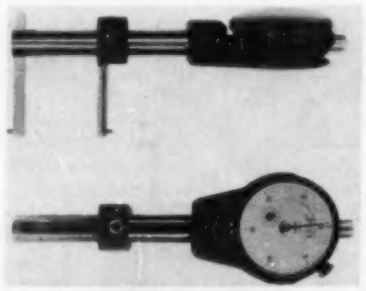
Longitudinal, transverse and vertical movements are transferred from full-size wood, plaster, plastic or metal full-form masters or templets, to the milling cutter through a manual stylus control.

The machine has two valves—a 3-D tracer valve mounted on adjustable slide for longitudinal, cross and vertical adjustments, for varying the relationship between the cutter and the stylus; also a servo-valve for variable depth control in 360° contour operations.

Specifications include longitudinal, cross, and vertical milling feed rates from 0 to 50 ipm, with traverse rate of 85 ipm. Machine is available in sizes 30 x 24 in., 36 x 24 in. and 42 x 24 in. with rated stroke lengths of 6, 8, 10 or 12 ft.

Rockford Machine Tool Co, Dept 201, 2500 Kishwaukee St, Rockford, Ill

MORE DATA? Circle 60, inside back cover



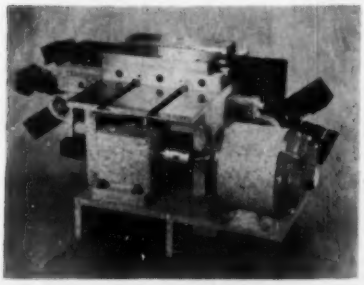
Dial Gage Checks Dimensions Of Internal Groove Diameters

Boice Groove Gage for use in short run production can be used for on-the-job checking or mounted rigidly to a bench stand. Unit is furnished with dial indicator graduated in 0.0005-in. readings and has indicator travel of 0.250 in. Range is adjustable from a minimum diameter of 0.750 to a maximum of 3.000 in., with a ⅛-in. max groove depth and 3/32-in. min groove width. Gage has a 1½-in. max throat depth.

Several design variations may be easily adapted to this unit.

Boice Gages, Inc, Hyde Park, NY

MORE DATA? Circle 61, inside back cover



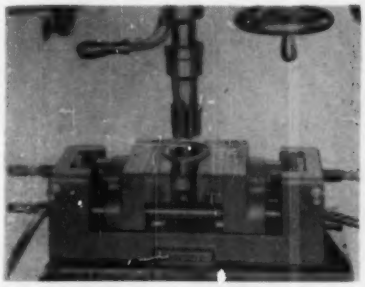
Motor-Driven Milling Fixture Speeds Milling of Small Parts

The Automatic Milled Parts unit is a continuously moving, automatic holding fixture designed for use in milling operations on small metal and plastic parts at rates of 1500 to 3000 parts per hr. Parts are hand inserted (or automatically hopper fed) into the 24 clamping jaws; the jaws clamp the parts and carry them beneath the milling cutter; the parts are ejected and the cycle continues.

Fixture can be clamped to any milling machine table; the table is then adjusted to proper position in relation to the cutter. Complete unit includes 24 matched holding jaws, 24 sets of matched jaw face blanks, a 1/3-hp motor, gear reducer and four pinions. Cost, assembled, is $2875.

Sieburg Industries, Inc, Danbury Industrial Park, Danbury, Conn

MORE DATA? Circle 62, inside back cover



Air-Hydraulic Vise Centers Parts Automatically

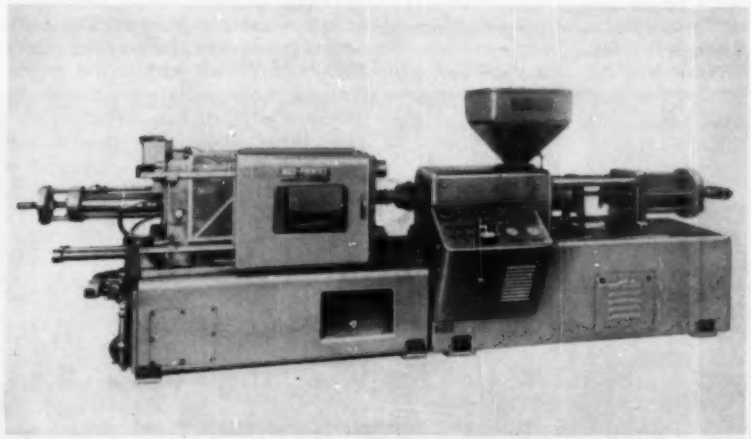
Model 77 air-hydraulic vise is designed for holding parts varying in size or shape when the work requires the location of a center or other pre-determined point. The two opposing jaws, actuated directly by cylinders on both ends of the vise, automatically adjust equally in relation to the centerline of the vise.

Jaw movement is synchronized within a tolerance of 0.001 in. by a gear and rack in the base. No pressure is transmitted through the centering mechanism.

Specifications include jaw width of 7 in.; maximum jaw opening of 7¾ in.; maximum travel for each jaw of 11/16 in.; total jaw travel of 1⅜ in. An air-hydraulic intensifier boosts air pressure into greater hydraulic pressure, developing a holding power on the work of 4000 lb at 100 psi. Vise can be equipped with a set of removable, soft steel, recessed parallel jaws.

Heinrich Tools, Inc, Racine, Wis

MORE DATA? Circle 63, inside back cover



Plastic Molder Combines Principles Of Extrusion and Injection Molding

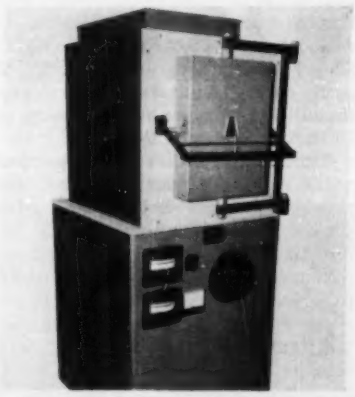
The Reed Jetflo combines the more efficient plasticizing of an extruder with the speed and accuracy of an injection molding machine. The machine facilitates high speed molding of thin sections, increased molding speeds on conventional items, and turns out products of higher quality.

First model in the line, the Jetflo 6 dry cycles in 1.3 seconds at minimum stroke and 2.9 seconds on a full 8-in. stroke. Basically, the machine consists of a 175-ton mold clamping mechanism and platens coupled to a 100-lb-per-hr extruder. Unique design of the extruder features a hollow screw with an actuating plunger within the bore.

Die plates measure 22 x 24¼ in. and provide 13½ x 13½ in. between the tiebars. The low pressure die closing system assures positive mold protection in fully automatic operation.

Reed-Prentice Div, Package Machinery Co, East Longmeadow, Mass

MORE DATA? Circle 65, inside back cover



High-Temp Furnace Simplifies Lab and Production Processing

Electrically heated Model KR-Super is designed for operation up to 3100 F without requirement of a protective furnace atmosphere.

Elements are protected with oxide coating. Vertical refractory separating piers between vertically suspended side-wall elements of hairpin design assure long element life and evenly distributed radiant energy to all portions of the furnace charge. Automatic time-temp run-up and automatic temp control by means of specially developed thermocouple - energized instruments provide accurate processing without skilled operator, or manual transformer tap switching. Swing door is double-pivoted.

K H Huppert Co, 6840 Cottage Grove Ave, Chicago 37, Ill

MORE DATA? Circle 64, inside back cover

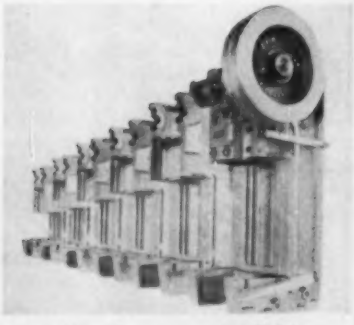
Disk Grinder Grinds Metallic or Non-Metallic Parts up to 18 in. Dia

Most recent addition to the company's 2H series of precision double horizontal spindle disk grinders, this larger machine, Model 2H4OL, is available with 36- or 42-in.-dia abrasive disks, and with a variety of work carrying fixtures for grinding metallic or non-metallic parts up to 18 in. in diameter.

The machine illustrated is equipped with rotary carrier fixturing for grinding two parallel sides of valve plates. It has a trough loader for feeding parts to the rotary carrier; automatic face cut mechanism for progressive stock removal; automatic diamond dresser; automatic size control; and integral wet grinding system.

Gardner Machine Co, Beloit, Wis

MORE DATA? Circle 66, inside back cover



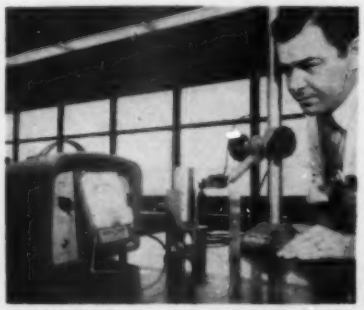
Kenco Punchpresses Available In Wide Range of Shut-Heights

Selection of shut-heights for presses in capacities of 2, 5, 8, and 15 tons is being offered by Kenco.

Thirty-two different models of punchpresses are available and, in most cases, each is furnished in a complete range of shut-heights. For example, in the 5-ton presses, manufacturer offers the Electro-Safe, Variable Speed and Standard Model in 5, 6, 7½, 8½, 10, and 11½-in. shut-heights, measured from ram to bolster with ram down and adjustment up. Deep throat and universal presses are also offered.

Kenco Mfg Co, 5211 Telegraph Rd, Los Angeles 22, Calif

MORE DATA? Circle 67, inside back cover



Compact, Transistorized Gages Offer Four Magnifications

Trans-O-Limit gages, featuring completely transistorized circuits, offer four magnifications, instantly selected by flicking a switch. Measuring optionally in thousandths, ten-thousandths, or millionths, these gages are reported to offer the widest total measurement range available.

The gaging circuit operates at 5000 cps, a rate appreciably higher than other gages of this type. This makes possible miniaturization of many components. As a result, gaging pressure is less than 1 oz. This line consists of a cabinet containing the power unit and indicating meter, which can be used with the Trans-O-Limit height gage (illustrated), external comparators, snap gages or cartridge units.

Pratt & Whitney Co, Inc, West Hartford 1, Conn

MORE DATA? Circle 68, inside back cover

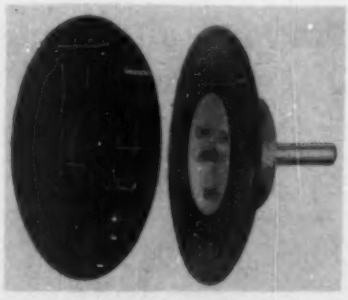
Portable Pneumatic Grinders Perform Variety of Operations

This new line of portable pneumatic grinders includes both horizontal grinders and die grinders. The horizontal grinders can be used for grinding, buffing and wire wheel work. Various sizes and models are available, with speeds from 3100 to 12,000 rpm. Wheel sizes range from 3 to 8 in. in diameter. Lever, straight, or grip-type handles may be specified.

The high-speed die grinders are available in two sizes, with rated speeds of either 40,000 or 60,000 rpm, and are suitable for a wide range of wheel sizes.

Thomas C Wilson, Inc, 21-11 44th Ave, Long Island City 1, NY

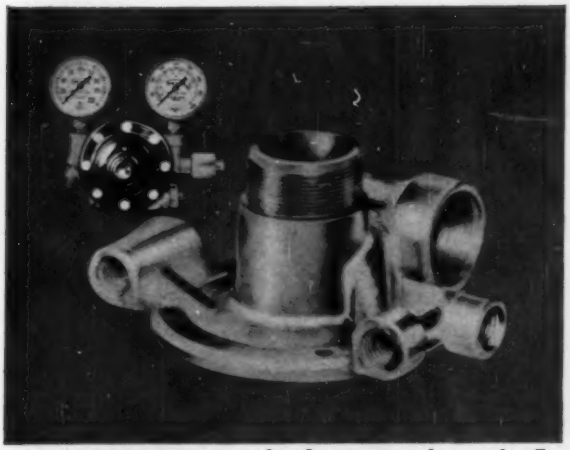
MORE DATA? Circle 69, inside back cover



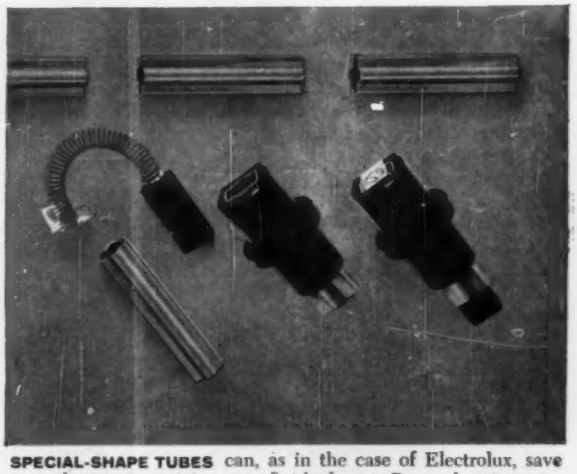
Flexible Abrasive Disks Attach Easily to Locking Holders

High-speed Contur flexible abrasive disks and locking holders have operating speeds up to 90,000 rpm, de-

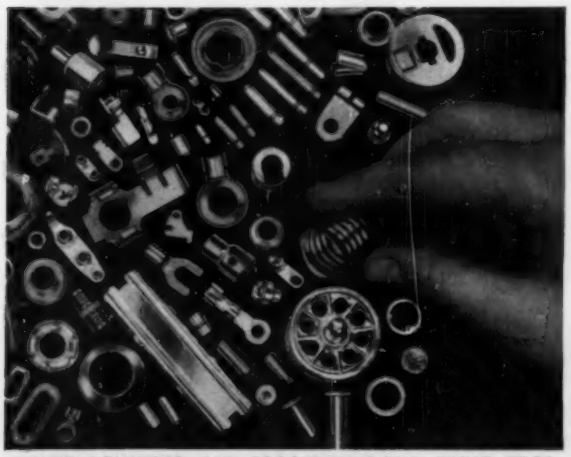
TAKE A FRESH LOOK at the way you are fabricating metal parts. Cost-cutting possibilities are almost unlimited with these Anaconda pre-formed mill products and press products.



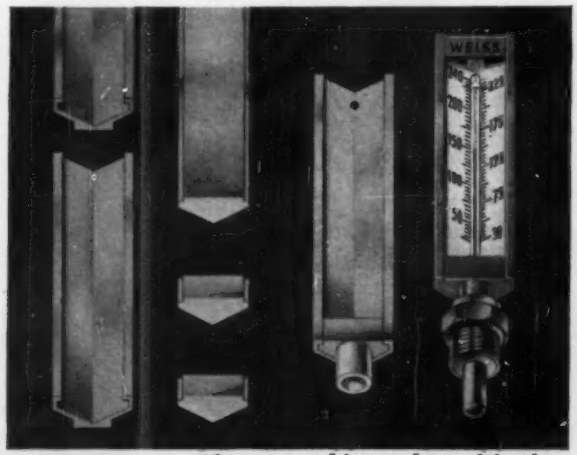
DIE-PRESSED FORGINGS, made of twice-wrought metal, offer superior uniformity, denseness, accuracy. *Savings*: replace more costly built-up assemblies—often are less in first cost than sand castings—require minimum surface machining to size—simplify secondary operations—lower tool cost—lower finishing cost.



SPECIAL-SHAPE TUBES can, as in the case of Electrolux, save several steps in arriving at a finished part. Brass electric-motor brush holder (above) is cut economically from long lengths of tube pre-shaped to accommodate both brush and spring. Uniform accuracy of all dimensions helps provide good brush stability.



MULTIPLE-PLUNGER AND PROGRESSIVE-TOOL-PRESS PRODUCTS are cutting costs throughout industry—often over 50%. Main reasons: The American Brass Company's complete design engineering service, long experience, specialized production equipment, a big selection of stock tools. Metals: copper, copper alloys, nickel, iron, steel, stainless steel, or aluminum.



EXTRUDED SHAPES. Wherever you fabricate from solid rod or bar—or castings—consider savings in machining, tooling and scrap by use of extruded shapes. Albert A. Weiss & Sons substituted two extruded shapes, above, for a sand casting—cut cost of thermometer case 41%, got an additional 30% saving in assembly because of consistently uniform dimensions.

HERE are four immediate approaches to cutting costs. Re-evaluate your designs and fabrication methods with these short cuts to finished products in mind. Wherever you spot a possible saving, send a sample, drawing, or description—with the quantity you need, the metal or properties you require—and ask for a quotation. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

DIE-PRESSED FORGINGS • SPECIAL-SHAPED TUBES
EXTRUSIONS • FABRICATED METAL GOODS

products of

ANACONDA®

Made by The American Brass Company

pending upon size. The disk holders are made of aluminum and are reported to have a long service life. The disks are bayonet locked to the holders; they reman concentric with the grinder spindle and will not wobble, vibrate or fly off.

The flexible abrasive disks are available in six diameters from ¾ to 4 in. and in popular grits from 24 to 320. The holders are made in three sizes. By using two Back-Pads or by omitting Back-Pads entirely, three degrees of flexibility can be obtained to fit the job. Holders are available with ⅛-, ¼- and ⅜-in.-dia shanks.

Foster Supplies Co, 6122 Milwaukee Ave, Chicago 46, Ill

MORE DATA? Circle 70, inside back cover

Liquid-Blasting Machine Cleans And Finishes Metal Parts

The Model 15 Hydro-Hone is a low-cost, liquid-blasting machine for high volume cleaning, finishing, peening, burnishing and deburring of metal parts. It can produce micro finishes ranging from 16 to 250 by adjusting air pressure and the size and type of abrasive media used. Depending upon the application, the unit will operate on 20 to 65 cfm of air at 90 psi.

The internal working area is 20 x 20 x 20 in.; but a side-entry door permits handling of even larger parts. For high volume finishing of small parts, such as nuts and bolts, the machine can be equipped with a tumbling barrel for automatic finishing. A blower removes vapors and fog.

Hydro-Hone Corp, 7516 Pacific Blvd, Huntington Park, Calif

MORE DATA? Circle 71, inside back cover

Induction Heating Unit Reduces Hardening or Annealing Time

This 12½-kw high-frequency induction heating unit is designed to reduce hardening or annealing time of continuously fed bandsaw blades from several minutes to seconds.

The feeding mechanism is synchronized to the power of the heating unit to obtain desired production. Power output is thyratron controlled to regulate the depth of heat penetration. Specially designed radio-frequency work coils concentrate the heat in the desired area without excessive heat travel into the blade itself.

Units are available in various sizes to meet any production requirements.

Scientific Electric, Inc, 111 Monroe St, Garfield, NJ

MORE DATA? Circle 72, inside back cover

Production Machine Feeder Combines With Range of Machines

Feedall Model 2500-C adapts to a variety of production machines to form a fully automated unit for high-speed output. It handles both rolling and sliding parts, has variable speed drive, and is portable.

Unit can be furnished with feed discharge chute at left or right hand or both. Take-off height is varied to fit specific applications. Feed range includes sliding parts ⅛ to 3-in. dia, 1 to 6 in. long; rolling parts 1 to 5-in. dia, ⅛ to 1½-in. thick. All types of automatic cycling controls are available. Feeder is self-powered with a ½-hp 220/440-v motor and has a 12-in. belt width. Over-all height is 89 in., loading height 46 in. Hopper has 12-cu-ft capacity.

Feedall, Inc, 38399 Pelton Rd, Willoughby, Ohio

MORE DATA? Circle 73, inside back cover

Tracer Unit for Flame Cutting Machines Follows Pencil Lines

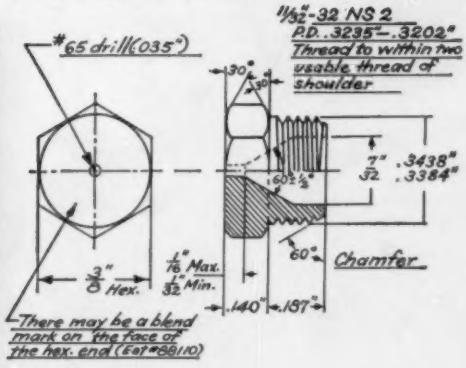
Designated the Linde Photocell Tracer, this tracer unit permits simple pencil line sketches to be used to guide oxygen shape-cutting machines. A built-in kerf compensator makes it possible to reproduce one or thousands of complicated metal parts easily and with extreme accuracy from exact-size drawings. Parts can be reproduced without the necessity of making allowance for kerf width on the drawing.

Tracer is not sensitive to extraneous light, nor will it follow shadows. Thus shape cutting can be done anywhere regardless of lighting conditions. Adaptable to both single and multiple-torch flame-cutting machines, the unit provides smooth, stepless speed control over a range of two to 30 inches per min.

Linde Co, Div of Union Carbide Corp, 30 E 42 St, New York 17, NY

MORE DATA? Circle 74, inside back cover

BETTER MACHINING STARTS WITH ALCOA SCREW MACHINE STOCK



MULTIPLE SPINDLE LAYOUT

Pc. No. V-10954	Time Per Pc.: 1.4 Sec.	Date: 7-21-55
Machine: ½" Dov.-Mod. "B"	Material Size: ½ Hex.	Material Grade: 2011-T3
Spindle R.P.M.: 3000	Chucks: ½ Hex.	Fingers: ½ Hex.
Spindle Gears: 42-21	Feed Gears: 60-30-60-30	
Kind of Threading Spindle: Steel	Ratio: 4:1 On 2:1 Off	
Threading: Rev.	Total Useful Rev. Pc.: 1.45	
Surface Speed: 340 Stock Ft. Per Min.	Min. Index Time: 2/5 Sec.	

SEQUENCE OF OPERATIONS

OPERATION	RISE	LEV.	FEED	CAM NO.	TOOL	HOLDERS
1—Box .330" dia.	.250	L.	.[illegible]		[illegible]h-up Std.	#20 Box Tool
Center					Pick-up [illegible]	in Above Tool
2—Drill 7/32" dia.	.250	L.	.0055	¼	60 Point 7/32 Drill	#20 Floating
Form	.125	L.	.0028	½	(Carb) V-10758	Circular
3—Drill .035" dia.	.125	L.	.0028	½	#65 Drill	#30 Floating
c o Part way	.125	L.	.0028	½	1/16 Th. Std.	Circular
4—Thread		1.11		#2	1 1/32-32 NS-2 Chasers	#101 H&G Die Head
5—Ream 60° angle				High Point Cam	V-10758	#20 Floating
Cut-off	.125	L.	.0028	½	1/16 Th. Std. Grind to .057"	Circular

PRODUCE THEM FROM ALCOA ALUMINUM SCREW MACHINE STOCK

ALCOA® Aluminum Screw Machine Stock gives three times more parts per pound than steel or brass. Of course, it's easier to move, stock and handle.

A free-machining metal, aluminum turns at remarkable feeds and speeds—1,000 ft/min is common. Aluminum retains the surface finishes produced by machining. You can polish, buff, brush or burnish it.

Aluminum doesn't punish tools. There's minimum down time for maintenance. Less heat, too—you can use lighter oils. Because aluminum resists corrosion, parts don't deteriorate in storage.

Find out more about better machining with ALCOA Screw Machine Stock. Here's how to do it:

- Meet Tom Conroy, ALCOA's field consultant. He'll be glad to demonstrate aluminum's advantages. See coupon.
- Ask for immediate stock delivery by calling the nearest ALCOA sales office or distributor.

ALCOA THEATRE
Fine Entertainment
Alternate Monday Evenings

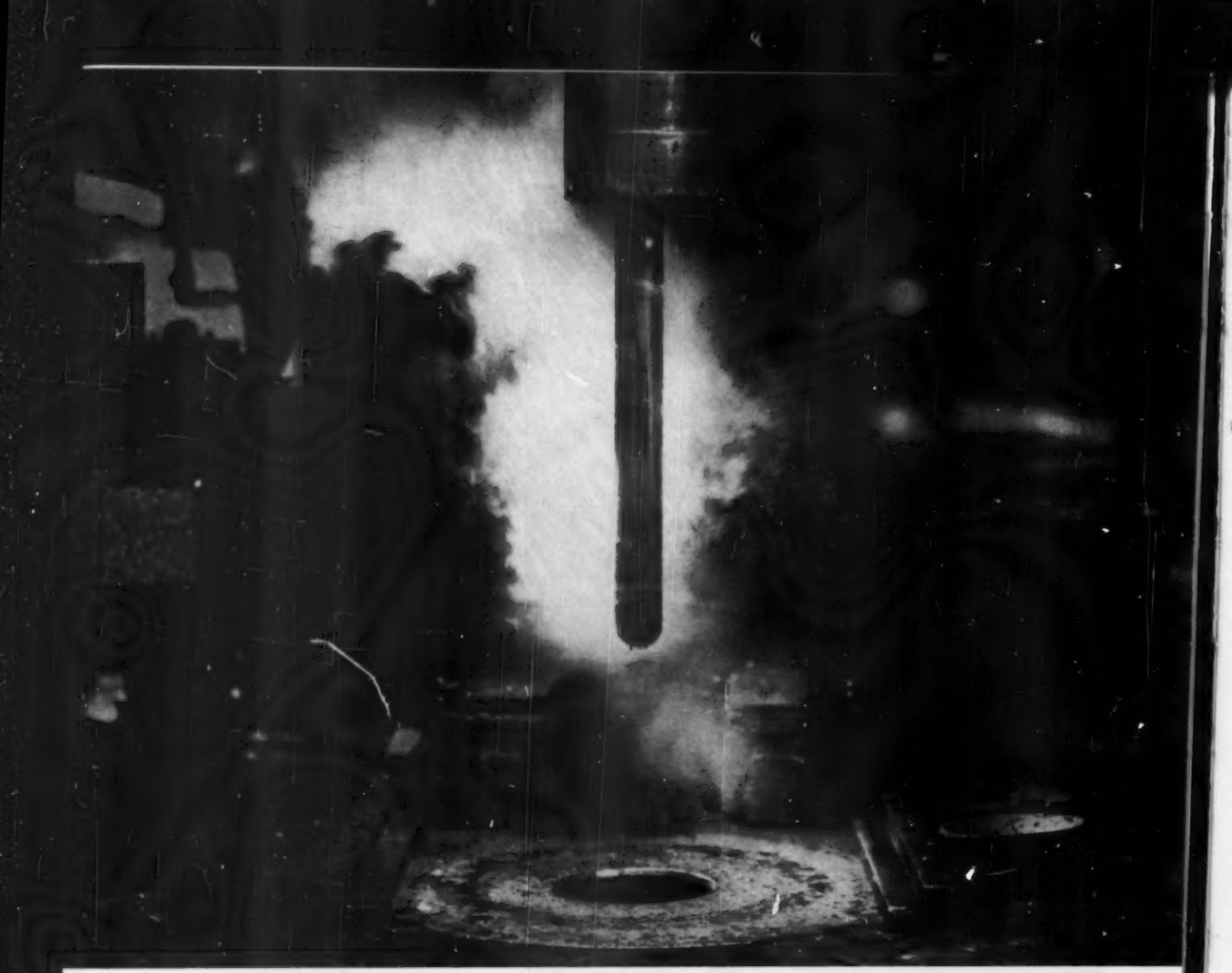
FREE!

Send for Alcoa's Speed Chart, a handy slide-rule calculator for every screw machine operator—and Alcoa Aluminum in Automatic Screw Machines, valuable procedures manual for production men.

ALCOA ALUMINUM

Look for this label . . . it's your guide to the best in aluminum value

Aluminum Company of America
868-Z Alcoa Building, Pittsburgh 19, Pa.
Yes, I'd like to—
☐ hear from Tom Conroy
☐ have a copy of your book and a *Speed Chart*
Name_____
Position_____
Company_____
Address_____
City_____ Zone____ State_____



Tough 2½" diameter mandrel at Rc 44 on 1150 ton brass extrusion press. Scovill Manufacturing Co.

Mandrel of HALCOMB 218 retains toughness and hardness at hot work temperatures...

This mandrel is made of Halcomb 218—a tough, air-hardening hot work steel. Halcomb 218 is suitable for tools like this which require a higher degree of toughness at moderately elevated temperatures than is obtainable with the tungsten types of hot work steels. And Halcomb 218 *retains both* its hardness and strength at these temperatures.

For example, at a hardness of Rc 44, Halcomb 218's Charpy Impact Strength is 33 ft-lbs at 500F. And it will retain this hardness after 1 hour, after 10 hours and even after 100 hours at temperatures up to 900F.

Properties like these cut tooling costs. The mandrel shown above is good for 1200 pushes, for example, and even then all it needs, usually, is repolishing before being used again.

Halcomb 218 is particularly useful for all hot work operations on which drastic coolants are used. It even resists breaking very successfully when water cooled in operation. If these sound like advantages you can use, call your local Crucible representative for more complete data. *Crucible Steel Company of America, Dept. TL01. The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE STEEL COMPANY OF AMERICA

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

CIRCLE 207 READER SERVICE CARD

FIELD REPORT . . .

Hoover Ball Purchases

Hoover Ball & Bearing Co, Ann Arbor, Mich, has stepped up its expansion program with acquisition of two ball manufacturing companies, Strom Steel Ball Co of Erwin, Tenn, and Coolidge Corp of Middletown, Ohio. Purchases were cash transactions; both companies will be operated as independent entities.

American Brake Shoe to Build $2 Million Research Center

Construction of a new facility to be known as the Denison Hydrodynamics Research Center is underway; it'll be operated by ABS's Denison Engineering Div, Columbus, Ohio. Primary purpose of the new center, expected to be in operation by next summer, will be to expand current research activities and to initiate advanced systems research in the fields of hydraulics, electronics, and pneumatics to meet needs of automated factories and complex weapons and air vehicle systems.

$16.9 Million Northrop Order

First production order for T-38 supersonic trainers for the Air Force has been received by Northrop Aircraft, Hawthorne, Calif. Contract covers initial funding for manufacture of T-38As, first production model of the lightweight, twin-jet trainer.

Yuba Consolidated Industries . . .

. . . San Francisco, has purchased Southwest Welding & Manufacturing Co, with plants in Alhambra and Richmond, Calif, and annual sales volume of $12 million. Southwest offers complete service for the engineering, fabrication, and field construction of heavy equipment for the atomic energy, petroleum, chemical, power, and hydroelectric industries.

Convair's Training Program For Machine Tool Operators

Training course has been set up at Convair Pomona to develop the machinist's manipulative skill and technical knowledge to the point where he can eventually progress to the status of a Class A operator. Students attend classes for four hours a day for four weeks. Instruction is given in theory and practice of basic shop work to develop ability to

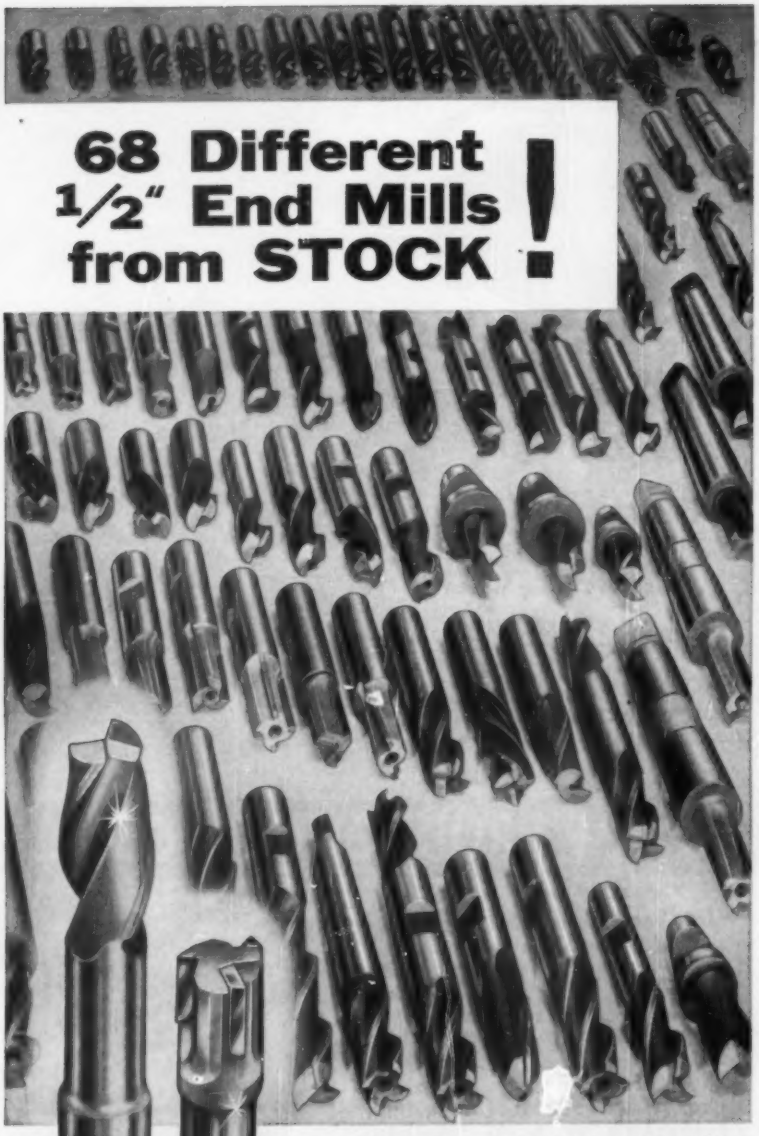
GOSS & DeLEEUW
AUTOMATIC CHUCKING MACHINES
perform one to three operations in sequence or simultaneously . . .
TO CUT PRODUCTION COSTS...

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.

Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



Most tool manufacturers would list many of these tools as "specials". At Brown & Sharpe they're all "stock boards"—off-the-shelf.
See your distributor. Never before such tooling service! Saves worry, waiting and costly "special tooling" over and over again.
Moral: Whether it's High Speed Steel, Carbide Tipped or Solid Carbide . . . for production *profit improvement,* specify B&S—NELCO.

SEND FOR CATALOG—To: Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

FOR THAT EXTRA EDGE IN PRODUCTION

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS

NELCO CARBIDE TOOLS

B·S

PROGRESS IN PRECISION FOR 125 YEARS

Field Report . . .

read and work from detailed drawings and blueprints; understanding of production machine tools and setup; ability to lay out and check work; and an understanding of cutting tool in relation to materials used.

Allis-Chalmers Plans to Buy . . .

. . . the S Morgan Smith Co, York, Penna, manufacturer of hydraulic turbines, valves, water handling equipment, and other specialized machinery. Purchase will be through exchange of stock. A-C expects to begin operating the Smith facilities by the beginning of the year. Smith directors have approved the plan; stockholders will have voted by the first of the year.

Lockheed West and South

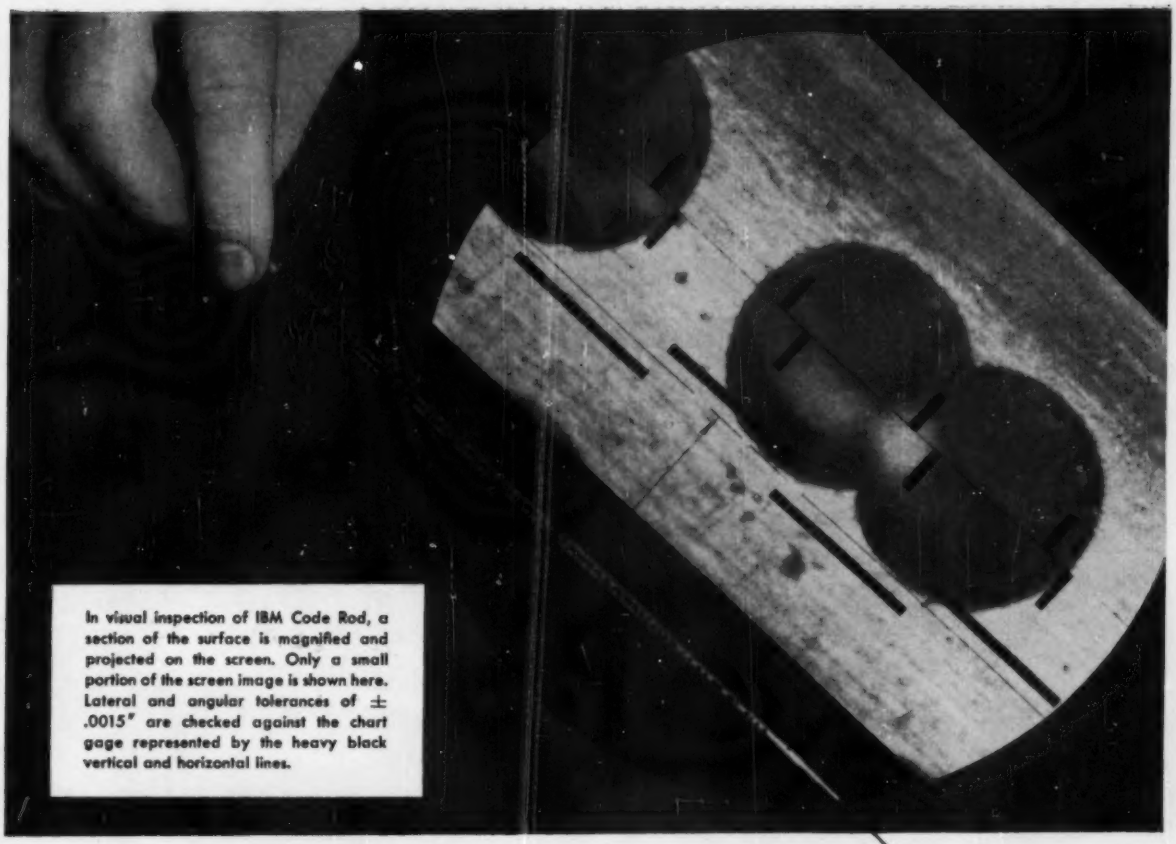
The Burbank plant has a Navy contract in excess of $10 million for preproduction work on the prop-jet Electra transport for anti-submarine warfare, and a $22 million order for new P2V-7s, extending production through Sept 1960. Company's Georgia Div is working on a $2 million contract for the first major modification work to be announced by the Air Force for the C-130A. Contract covers work on 40 Hercules from Tactical Air Command and Pacific Air Force C-130 wings.

H-VW-M Sets Up Plastisol Shop

Hanson-Van Winkle-Munning Co, Matawan, NJ, is now applying plastisol coatings to plating equipment it manufactures, is also taking orders for custom coating of plating equipment. New facilities enable the company to perform all related operations including sandblasting, priming, preparatory baking, coating by both spray and dip processes, and final baking after application of the plastisol.

Aeronca-Longren Merger

Negotiations are underway for merger of Aeronca Manufacturing Corp, Middletown, Ohio, and Longren Aircraft Co, Torrance, Calif. Aeronca produces large sub-assemblies constructed of aluminum and stainless steel brazed honeycomb for military aircraft. Longren, also engaged in making aircraft assemblies, would be operated as an Aeronca division. Acquisition, subject to approval of shareholders, will be an exchange of stock transaction.



In visual inspection of IBM Code Rod, a section of the surface is magnified and projected on the screen. Only a small portion of the screen image is shown here. Lateral and angular tolerances of ± .0015" are checked against the chart gage represented by the heavy black vertical and horizontal lines.

How would you gage these 1,118 holes?

Here's how IBM did it... and smashed an inspection bottleneck

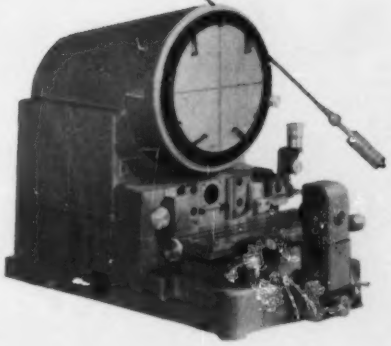
Here's how International Business Machines Corporation boosted the inspection rate on its new Code Rod from 1 or 2 *per day* to 15-20 *per shift*—keeping pace with production, yet maintaining complete accuracy—with a Kodak Contour Projector, Model 14-2A.

The Code Rod is used with the new 720 High Speed Wire Printer, developed by IBM to overcome the speed limitations of conventional bar type printers. The rod is a stainless steel tube with no less than 1,118 1/32" holes. The holes are drilled in various combinations at 7 different intervals in 7 straight rows down the 8" length of the tube. Obviously the inspection problem is of no small proportions.

Lateral and angular tolerances for the holes are ± .0015". *To maintain these tolerances is critical because any mis-drilled holes would cause an error in the shape of the characters to be printed.* What's more, the 720 Printer operates at extremely high speeds, and any slight error could affect its operation.

In visual inspection a master Code Rod is placed next to the rod to be inspected. Both surface images are projected on the screen. The operator simply indexes the image along simultaneously, so that he always has a correct rod in view for comparison of the hole grouping. He checks tolerances by a chart gage on the projector screen.

Got an inspection bottleneck at your plant? Optical gaging with a Kodak Contour Projector may well be the answer. The booklet "Kodak Contour Projectors" gives examples of how other firms are profitably using Kodak Contour Projectors, plus full data on the various models we offer. The booklet is available on request from:



Kodak Contour Projector, Model 14-2A, is a versatile precision measuring instrument for production lines or toolroom. It is one of 6 Kodak Contour Projector models available to meet all your optical gaging needs. Operators work in complete comfort, need little training.

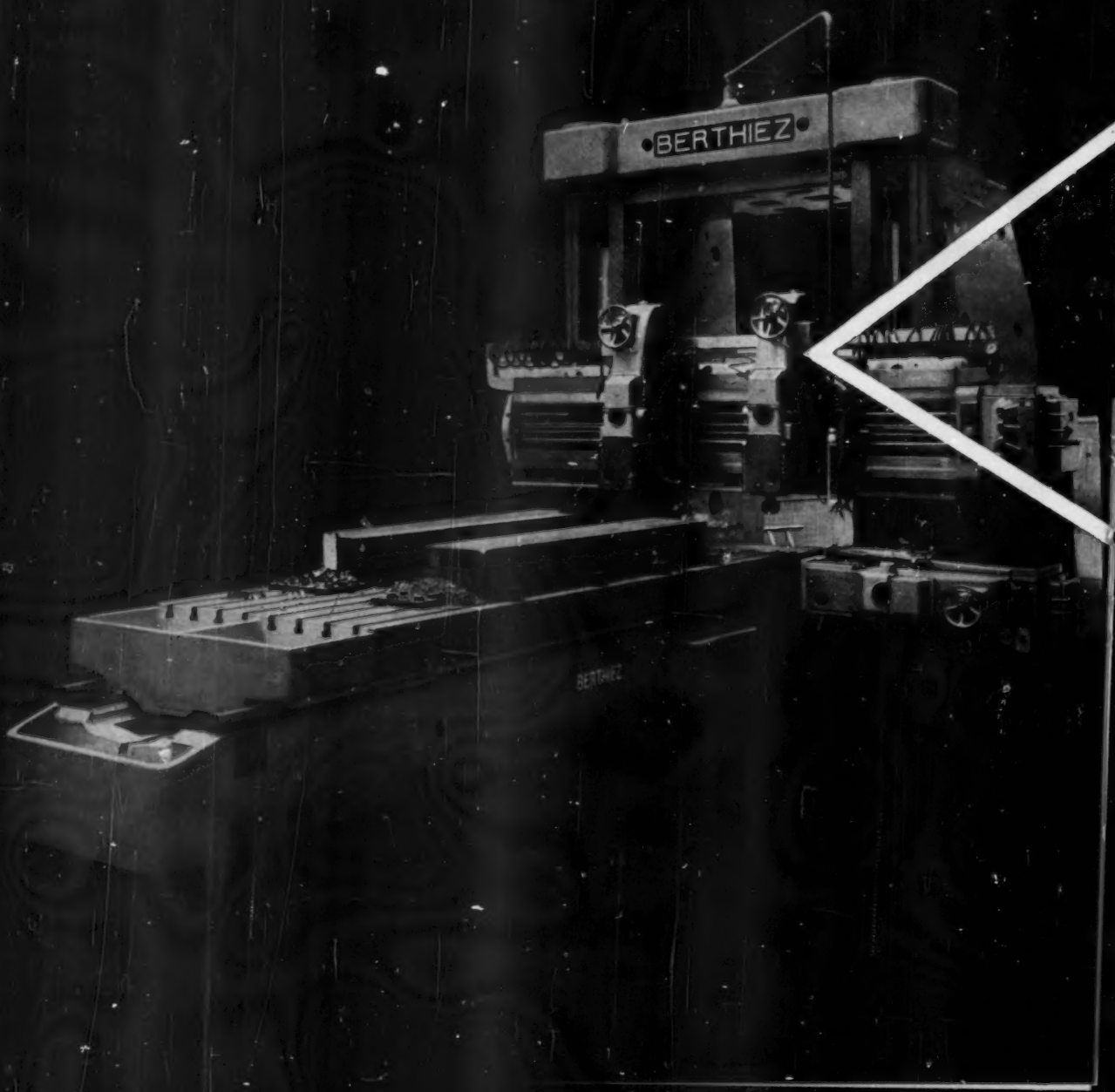
Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

BERTHIEZ has been
CUTTING BOTH WAYS,
COMING AND GOING for
the last 12 years
BERTHIEZ has been rough and finish
CUTTING BOTH WAYS with
multiple tools for the last 10 years



BERTHIEZ has supplied over 100 large Single and Double Upright Planers CUTTING BOTH WAYS, COMING AND GOING since 1946 which have been working year in and year out ON DOUBLE WAY CUTTING

BERTHIEZ

HEAD OFFICE, 5, RUE MONTALIVET, PARIS (FRANCE)

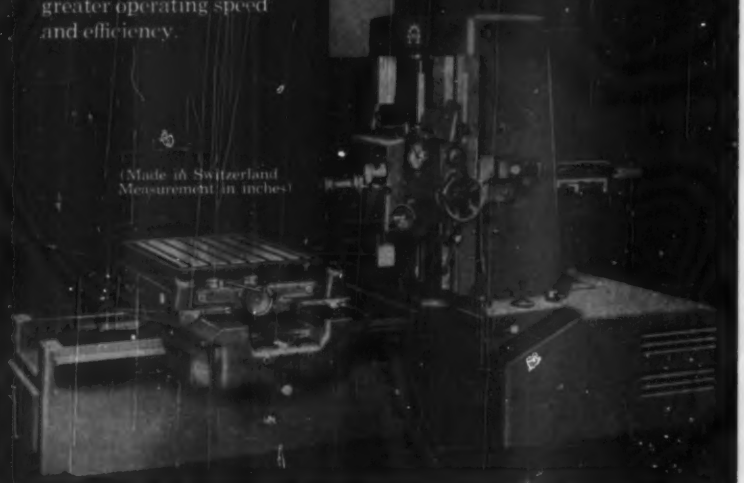
ACCURACY + VERSATILITY

the DIXI 75 gives you horizontal optical jig boring

- Projected optical setting—direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference.
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29½" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel

PLUS...

- Automatic positioning device available.
- Simplified controls functionally arranged for greater operating speed and efficiency.
- Hydraulic feeds and infinitely variable spindle speeds.
- Rear support optional.



(Made in Switzerland. Measurement in inches)

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York. — Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

See the Dixi 75 at our Cleveland Demonstration Center (Sloan Machine Co., 18714 Nottingham Road, Cleveland, Ohio)

MBI

M. B. I. EXPORT & IMPORT LTD.

A DIVISION OF MACHINERY BUILDERS, INC.

475 Grand Concourse, Bronx 51, N. Y.

"Over 25 years' experience in designing and building machinery."

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 SURFACE GRINDING MACHINE—*Brown & Sharpe Manufacturing Co, Machine Tool Div, Providence 1, RI.* 12-page bulletin GM 54 contains description and specifications on Model 510. Design features and accessories illustrated.

2 OPEN BACK INCLINABLE PRESSES—*Federal Press Co, Division St, Elkhart, Ind.* 20-page catalog 1014-11-58 illustrates and describes 22 models, each available with either gear or flywheel drive. Sizes range from 7 to 100-ton capacities. Chain or gear-driven Dial Feed units, and a new specialty machine, the Flying Cutoff, also covered.

3 PRECISION BORING MACHINES—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* Illustrated bulletin 315814 gives data on largest standard horizontal units in the line. Hydraulically operated models accommodate large workpieces and heavy fixtures. Style 771 is a single-end machine, 772 is for double-end operations. Includes construction details, applications, specifications.

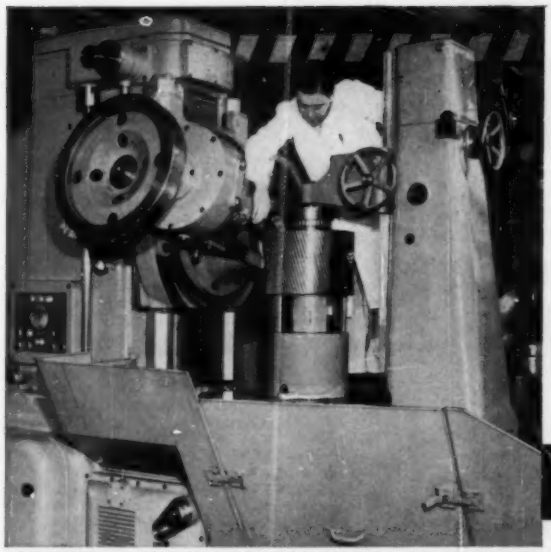
4 LATHES—*Louis Levin & Son, Inc, 3610 S Broadway, Los Angeles 7, Calif.* 43-page indexed catalog covers precision units for small parts manufacture. Models illustrated; features described; specifications given for each; accessories and attachments pictured and discussed.

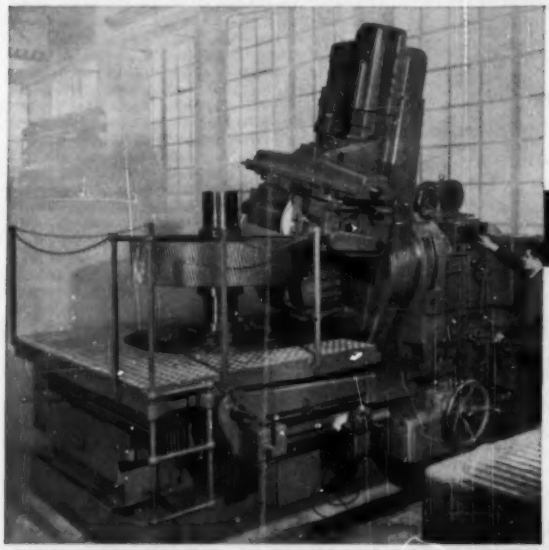
5 WET ABRASIVE CUTTING MACHINE—*American Chain & Cable Co, Allison-Campbell Div, 929 Connecticut Ave, Bridgeport 2, Conn.* 4-page bulletin DH-84 provides details on Model 481 for tough cutoff jobs. Unit will cut solid billets, pipe, or structurals, and any shape that will fit into an 8-in. circle or square. Hardened steel, titanium, high-temp alloys, corrosion-resistant metals can be cut at rate of 8 to 10 sq in. per minute. Workholding fixtures, specifications included.

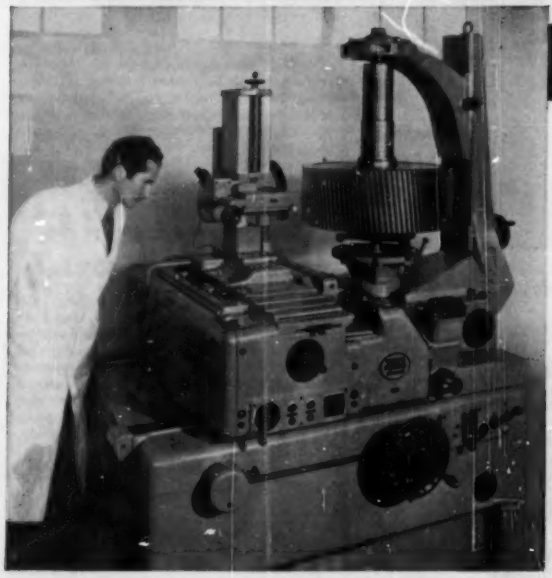
6 PUNCHPRESSES—*Kenco Manufacturing Co, 5211-½ Telegraph Rd, Los Angeles 22, Calif.* Literature illustrates and describes features of 2-ton and 5-ton models. Includes accessories and specifications.

7 GEAR SHAVING MACHINE—*National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich.* 12-page illustrated bulletin S-56-1 gives details on Model GCI designed for conventional shaving. Design and operating features pictured and discussed; specifications tabulated.

"Once the parts are machined, Burton loses all interest in them."







HIGHEST QUALITY GEARS

Now Super-Precision Ground Tooth Gearing up to 72″

by phillie gear

CUT ACCURATELY

In addition to 66 years experience and 3 large, modern plants, Phillie Gear has the World's latest and finest machines for producing gears . . . Special attention is given to selection of materials, machining, heat treatment, and tolerances—all with one thing in mind: to give you the *Highest Quality Possible.*

GROUND ACCURATELY

Illustrated is our latest gear grinder for Spur and Helical Gearing up to 72″ diameter . . . the ultra precision work table is certified accurate to 4.3 arc seconds total accumulative error . . . this custom built machine is the most accurate large gear grinder in America. High Precision Gears ground on this machine open new horizons of accuracy and performance of large gearing for Radar, Marine, Turbine and many similar applications. Phillie Gear has five additional High Precision Gear Grinders.

CHECKED FOR ACCURACY

All gears made by Philadelphia are analyzed on modern testing machines—and then must pass the most rigorous inspection by specially trained men, before shipment—There is no "guesswork" at Phillie Gear.

Phillie Gear is licensed to manufacture World famous Maag designed precision gear products.

Send for our latest 72 page "Gear Book"—it's practically a treatise on the subject of gears . . . Please use your Business Letterhead when requesting a copy.

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Offices in all Principal Cities

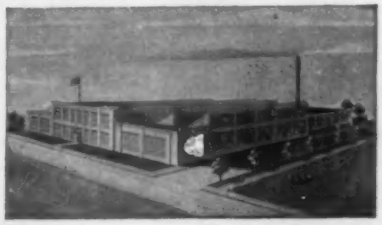
Here's how CDT can help you

CDT CAN INCREASE YOUR PRODUCTION
. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

CDT CAN LOWER YOUR PRODUCTION COSTS
. . . by increasing the efficiency of your operation with special tools that do the job better—faster—more economically.

Call on Columbus Die-Tool for your special tooling problems. A large creative engineering staff with experience in developing special tools and machines for hundreds of industries is at your service. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to exacting requirements. Avail yourself of the industry-wide experience of Columbus Die-Tool.



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Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

8 STAMPING PRESSES — *Alpha Press & Machine, Inc, 9231 Freeland Ave, Detroit 24, Mich.* 12-page bulletin 855P pictures and describes line of high-speed, 2-point, underdrive units in standard capacities from 50 to 300 tons. Roll feeds and scrap cutter are an integral part of the design; drive mechanism is enclosed within the steel frame. Dimensions and specifications included.

9 PRODUCTION BENDING MACHINES—*Pedrick Tool & Machine Co, 3638-40 N Lawrence St, Philadelphia 40, Penna.* 8-page bulletin 58 contains illustrated descriptions of line of compression process production bending units from smallest Model A-3 with 7500 in.-lb bending moment up to big Model E-2 that develops 367,000 in.-lb. New Pedrimatic Automatic also covered. Data on general bending theory and practice included.

10 HYDRAULIC PRESSES AND PREFORMERS—*Logan Hydraulics, Inc, 4901 W Lawrence Ave, Chicago 30, Ill.* 15-page catalog contains information on complete line of preformers available in 30, 50, 70, and 125-ton capacities. Units may be used with single, two, and three-cavity dies for faster production. Self-contained molding presses range from 10 to 400 tons. Units can be controlled automatically or semi-automatically and with various pressures required for all types of molding materials.

11 HIGH CAPACITY TESTING MACHINES—*Tinius Olsen Testing Machine Co, 835 Easton Rd, Willow Grove, Penna.* 12-page brochure covers universal machines of 1-million-lbs capacity and over. Discusses various features of the hydraulic Super L machine including the advantages of four screw design to achieve max rigidity and crosshead stability under load.

12 AUTOMATIC CUTTING MACHINES—*Motch & Merryweather Machinery Co, Wink Div, 1250 E 222nd St, Cleveland 17, Ohio.* 8-page bulletin W100 presents information on high-speed units that cut material up to 3-in. dia in lengths of 1/16 in. to 60 ft; speeds up to 1500 per min. Specifications and accessories included.

13 FLEXIBLE SHAFT MACHINES — *Stow Manufacturing Co, 22 Shear St, Binghamton, NY.* 8-page catalog 59 contains illustrated data on multi-speed or single-speed models for grinding, sanding, polishing, buffing, wire brushing, and drilling in steel or wood. Machines are available with truck, pedestal, bench, and suspension-type mountings. Information included on standard flexible tool shafts, power drive flexible shafts, and small drill shafts, as well as complete line of accessories.

TOOLS AND ACCESSORIES

14 TOOLHOLDERS—*Viking Tool Co, 1000 Nichols Rd, PO Box 471, Shelton, Conn.* 12-page catalog 581 describes new line of throwaway insert toolholders that eliminate necessity for a separate chipbreaker. Design features a top clamp, carbide hard-faced, which combines chip control with insert clamping. Section included on throwaway inserts in four different cutting materials: carbide, cast alloy, oxide, and HSS. Back cover is a carbide grade comparison chart.

15 ASSEMBLY TOOLS — *Waldes Kohinoor, Inc, 47-16 Austel Pl, Long Island City 1, NY.* 16-page catalog AT 10-58 contains complete engineering dimen-

sions and specifications for all Waldes Truare retaining ring pliers, applicators, dispensers, and grooving tools. Selector Guide covers 20 standard ring series, including recommended assembly tools for each ring type.

16 PRECISION PRESSURE GAGES — *American Chain & Cable Co, Helicoid Gage Div, 929 Connecticut Ave, Bridgeport 2, Conn.* 36-page booklet, catalog DH-65 illustrates and describes the newly designed Safe-T-Case gage for severe or dangerous services, as well as complete line of Helicoid gages. Engineering data covers operation, types of systems, adjustments, applications, dimensional drawings, specifications, accessories, plus list of recommended uses.

17 OPTICS — *Edmund Scientific Co, Barrington, NJ.* 96-page catalog 589 lists hundreds of quality control aids—measuring magnifiers, variety of microscopes, pocket comparators, illuminators, projection sets—other instruments and components. Includes more than 1000 optical items. Illustrations and technical data included.

18 ROUGH AND FINISH BORING AND REAMING TOOLS—*Muskegon Tool Industries, Inc, 11th St at Western, Muskegon, Mich.* 18-page catalog illustrates and describes features including floating cutter action of the finish reaming tool, ample chip clearance, single-screw adjustment, and interchangeability which permits changing of cutter without removing bar from machine. Dimensional and ordering information provided.

19 MOUNTED WHEELS — *Chicago Wheel & Manufacturing Co, 1101 W Monroe St, Chicago, Ill.* 4-page illustrated bulletin 1505 indicates exact dimensions and prices. There are 200 standard sizes and 86 standard shapes available in a variety of bonds, including vitrified, resinoid, and soft rubber polishing.

20 TRI-ROLL THREAD COMPARATOR—*Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 20-page illustrated bulletin 606 outlines advantages of instrument. Data provided on types of gage rolls, correct selection, mounting, analyzing the readings, setting up for operation, components and accessories, applications.

21 CUTTERS — *Ingersoll Milling Machine Co, Cutter Div, 505 Fulton Ave, Rockford, Ill.* Booklet K-68 discusses ways to improve milling and boring operations. Covers importance of matching cutters to exact capabilities of machines and to work; recommendations for getting max performance from replacement blades; setup and cutter sharpening equipment; description of typical milling and boring cutters, tool designs, and factors affecting selection.

HEAT TREATING AND WELDING

22 SPECIAL PURPOSE ELECTRODES *Lincoln Electric Co, Cleveland 17, Ohio.* 20-page catalog 7000.2, new Weldirectory, is a procedure guide for Lincoln manual arc welding electrodes for hardsurfacing and for welding stainless steels, non-ferrous metals, and cast iron. Each electrode described with properties, applications, and pointers on how to use. Charts aid selection and identification and give welding machine settings for each.

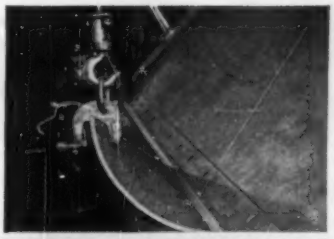
23 ALLOYS AND FLUXES FOR ALUMINUM—*All-State Welding Alloys Co, White Plains, NY.* Folder provides information on joining aluminum to itself or to dissimilar metals. Range of alloys now includes electrodes, welding rods, brazing rods, 1-lb and 10-lb precision spooled wire for inert gas application, and wide selection of solders affording joint strengths to 25,000 psi tensile.

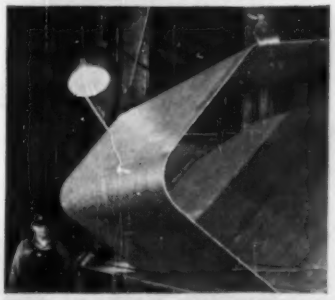
Bending Steel Plates for WELDMENTS?

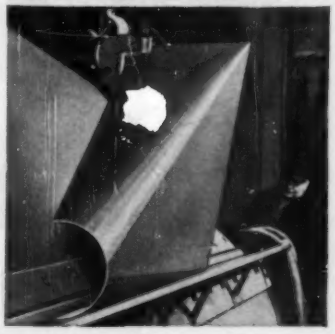
do it economically with

CHICAGO® POWER BENDING BRAKE

(no dies needed)





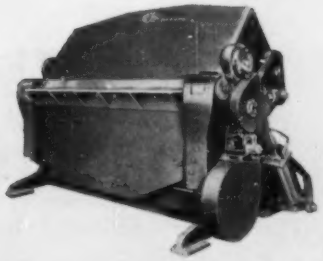


The accompanying illustrations give an idea of the versatility of the CHICAGO bending brake. No dies have to be changed or adjusted—no dies are used on these jobs. Yet, duplication is easily obtained on successive pieces. The machine is quickly adjustable for different thicknesses of material up to rated capacity. Automatic stop regulates the angle of bend. This, too, is adjustable to any degree of bend. The ease of changing from one job to another and the elimination of die costs make the CHICAGO bending brake the economical method for bending steel plates for weldments.

Many standard sizes are available with capacities for bending mild steel up to 12 feet by ¼ inch or 16 feet by ½ inch. Also many standard sizes in hand and power operated models for sheet metal.

BULLETIN P-55
This bulletin gives the details of how these and many other jobs are handled. Also complete description of the machine and specifications of the standard sizes.
Ask for a copy.

Front view of one of the heavy duty models of CHICAGO power bending brake showing the operation end of the machine.



Recommendations for any job on request.

6473

CHICAGO DREIS & KRUMP

Press Brakes • Straight-Side Presses • Press Brake Dies

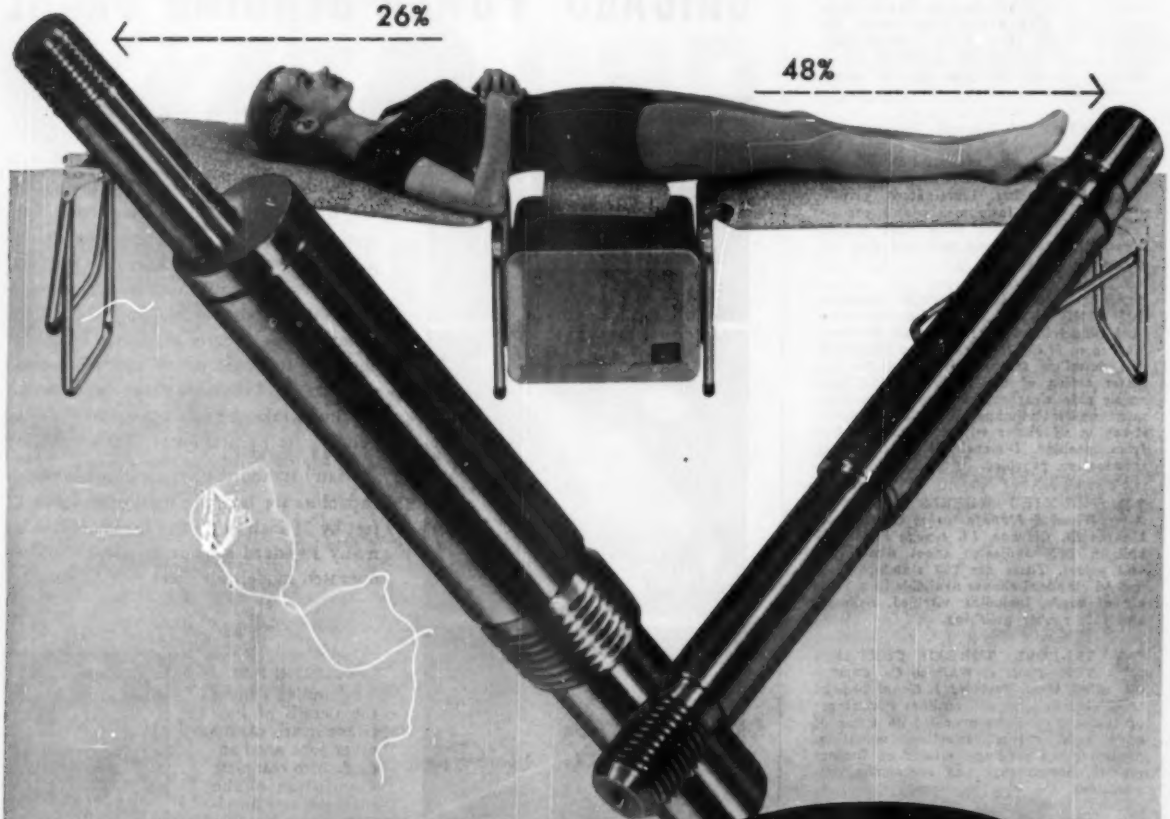
Hand and Power Brakes • Special Metal-Forming Machines

DREIS & KRUMP MANUFACTURING CO.

7434 South Loomis Boulevard, Chicago 36, Illinois

SHE is improving her figure on a Stauffer "Magic Couch." And although she doesn't know it, Stauffer makes two of the Magic Couch's most important operating parts from LaSalle ground and polished STRESSPROOF® steel bars. This means that her Magic Couch will last longer, will be more dependable.

Stauffer reduces cost figures, too!



Stauffer reduces part costs 26% and 48% by using today's improved ground and polished...

STRESSPROOF® STEEL BARS WITH COPPER

ELIMINATES Heat Treating

This eccentric shaft . . . and this idler shaft, two of the most important parts of Stauffer's Magic Couch, were formerly made of heat treated C-1137. But Stauffer design engineers recommended a change to LaSalle ground and polished STRESSPROOF® steel bars . . . with copper.

The result: no need for rough grinding . . . no need for expensive heat treating. Production costs were reduced 26% on the eccentric shaft . . . 48% on the idler shaft.

Today's improved ground and polished STRESSPROOF® can help your per-part cost. It gives high strength without heat treating . . . it machines 50% to 100% faster than heat treated alloys . . . it minimizes warpage . . . it makes a better part at a lower cost.

To find out how STRESSPROOF® can help you, just write for a copy of the newly published bulletin, "Today's Improved LaSalle Stressproof Steel Bars . . . with copper." Or for production applications, ask for a sample bar for test purposes.

LaSalle STEEL COMPANY

1416 150th Street, Hammond, Indiana

Lawrence C Gleason (left) has been elected president of Gleason Works, Rochester, NY. He succeeds **Emmet Blakeney Gleason** who died Nov 21 (*AM* — Dec 15, p172). The new president, a grandson of the firm's founder, was formerly assistant treasurer and has been a director of the company since 1947. **Dwight Vande-Vate** (right), a vice president, has been named general manager, and **H F Carver**, also a vice president, assistant general manager

Milton E Berglund, executive vice president of the Torrington Co, Torrington, Conn, has been elected president to succeed **Walter C Thompson**, named board chairman. **Rodney T Dunlap**, a vice president, takes over Mr Berglund's former post

NAMES IN THE NEWS...

Thomas A Fribley, a vice president of Cleveland Cap Screw Co, has been elected executive vice president of the firm. **Robert E Thomas**, general sales manager, has been promoted to vice president, sales.

George L Rylands has been named executive vice president of Cullman Wheel Co, Chicago.

Stephen A Yasko has been appointed vice president, director of sales, of the Berkeley Co, Danville, Ill, manufacturer of welding machines and equipment. He was formerly manager of sales engineering of Westinghouse Electric Corp's Welding Division, Buffalo.

Norman J Kirk has been elected president and general manager of the Toledo Pipe Threading Machine Co. Prior to joining the company Mr Kirk was vice president and general manager of the Toledo operations of E W Bliss Co.

R C Rieder, works manager of Baker Perkins Inc, Saginaw, Mich, has been elected vice president, manufacturing.

Homer F Griffith has been promoted from assistant manager to manager of International Harvester Co's Tractor Works in Chicago. He succeeds **H A Torgersen**, named manager of Harvester's Fort Wayne Works.

William A McCullough Jr has been appointed sales manager of W O Barnes Co, Detroit. He takes the place of **Vernon H Olson**, recently elected president (*AM* — Dec 1, p179). Mr McCullough was formerly assistant domestic sales manager at Nicholson File Co, Providence, RI.

John F Cain has been named general manager of Greer Hydraulics, Inc, Jamaica, NY.

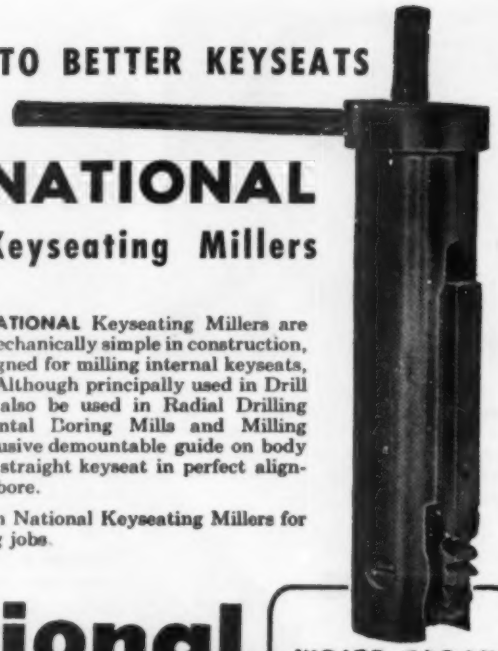
Donald A Gaudion has been elected president of Pfaudler Permutit Inc, Rochester, NY. **Mercer Brugler** has been named chairman of the board and will continue as chairman of the executive committee. **C Wendell Beck**, assistant general manager of the Pfaudler Division, has been appointed general manager, the post formerly held by Mr Gaudion.

Louis F Polk, vice president and group executive of Bendix Aviation Corp, and president of the Sheffield Corp, Dayton, Ohio, has been elected president of the American Ordnance Association

Hans Ernst, director of research at Cincinnati Milling Machine Co for 32 years, has been appointed Herman Schneider research professor at the University of Cincinnati's College of Engineering

Irvin R Spangler has been named sales manager for the machine and tools division of Michigan Tool Co, Detroit. Formerly assistant sales manager, he succeeds **Paul F Zerkle** who will be working on special assignments

THE KEY TO BETTER KEYSEATS



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NATIONAL Keyseating Millers are mechanically simple in construction, sturdily built, designed for milling internal keyseats, faster and better. Although principally used in Drill Presses they can also be used in Radial Drilling Machines, Horizontal Boring Mills and Milling Machines. An exclusive demountable guide on body of Miller assures a straight keyseat in perfect alignment with axis of bore.

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NAMES IN THE NEWS . . .

Colin Sharp has been named west coast manager of Brown & Sharpe Manufacturing Co's Cutting Tool Division

John D Williams has been elected president of Lipe-Rollway Corp and Rollway Bearing Co, a subsidiary. He succeeds **H Follett Hodgkins, Sr,** named board chairman. Mr Williams was formerly vice president of Lipe-Rollway and vice president and general manager of Rollway Bearing

Robert M Zimmerman has been elected vice president of Lipe-Rollway Corp, Syracuse. He will continue to serve as general manager. **H Follett Hodgkins Jr** has been appointed vice president of Rollway Bearing Co.

Robert E Schwary has been appointed manager of engineering of the Hydreco Division of New York Air Brake Co. He replaces **R F Hodgson,** named general sales manager to succeed **E J Hrdlicka** who has resigned.

Henry S Black has been appointed director of Consolidated Electrodynamics Corp's DataTape Division. Formerly manager of CEC's southwestern regional sales office in Dallas, Mr Black succeeds **Phillas H Girouard,** named development coordinator.

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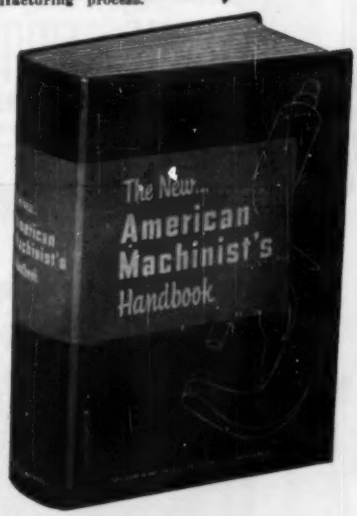

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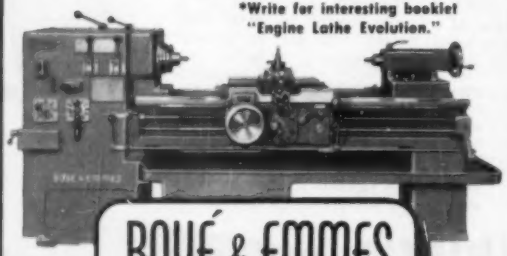

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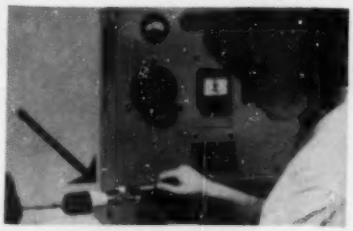

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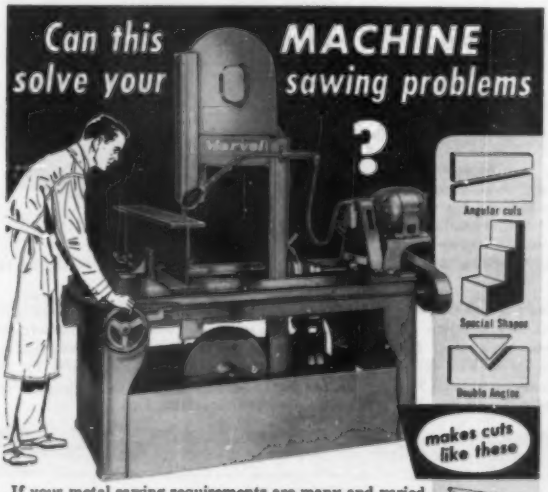

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CIRCLE 223 READER SERVICE CARD

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30" Wickes Center Drive Lathe, 60' bed
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650B Barnes Hone, 16', 12" dia.
249 Barnes Hone, 9" st., 18" swg.
306 Barnes Hone, 25" st., 30" sw.
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Rt. 6 @ Alexander Rd., Bedford, Ohio

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HARRY E. MILES

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BALANCER, Model 2EO Tinius Olsen, 154b
BORER, No. 1212 Excello, dbl. end
BORING MILL, 3¾" bar No. 5 Defiance, 1942
BORING MILL, 4" Universal Tri-way 1000 RPM
BORING MILL, 60" Gisholt vert. PRT
CENTERING MACHINES, Nos. 88 and 56 Sundstrand up to 72"
CUTOFF, ½"-3" No. 3A Modern auto. 1950
DRILL, RADIAL, 5' x 20" Western heavy duty
DRILL, UPRIGHT, 24" Cincinnati Bickford, tapping, No. 4 MT power feed
DRILL, No. 20HO Baker hydr. late
GRINDERS, C'LESS No. 12 Landis, 1947
GRINDERS, CYL. 4" x 12" No. H Landis, 1943
GRINDERS, UNIV. 14"x14" Mod. 112 Rivett, 1942
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., plain, 1941
GRINDER, INT. No. 75A Heald hand feed
GRINDER, SURF. 8" x 24" DoAll hydr. 1948
GRINDER, SURF. 20" and 24" No. 25A Heald
GRINDER, SURF. 36" Nos. 18 & 16 Blanchard, 1940
GRINDER, CUTTER, 30" Ingersoll, 1942
GRINDER, CARBIDE, Nos. 48 & 49 Excello, 1941
GRINDER, RADIUS, No. 48 Van Norman, late
GRINDER, TOOL & CUTTER, No. 2 Cincinnati
HOB SHARPENER, Type HRS Barber Colman
KELLER, BL24IG Pratt & Whitney 3 Spdl., 1941
LATHES, ENGINE, 13", 15" & 17" LeBlond Regals, new
MILLER, AUTO 36" No. 33 Sund-tran-l
MILLER, HAND No. 2RV Kent-Owens, 1942
MILLERS, No 18 & 3 Van Norman Duplex
MILLER, PLAIN, No. 3H K&T MSDT 1943
MILLER, PLAIN, No. 2 Cincinnati
MILLER, VERTICAL No. 2 Brown & Sharpe, 1943
MILLER No. 36 Van Norman, ram type 1942
ROUTERS, Type A-1R Onsrud Radial 84", late
SAW, 6" x 6" No. 6 Marvel Hack, late
SAW, 10" x 10" Racine Hydr. Hack, 1941
SHAPER, 6" & 12" P.&W. Vertical

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Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

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By rapidly growing mfr. of highest quality, precision engineered rod ends, spherical bearings, linkage assemblies. Only established reps with good sales record to design engineers considered. Write with full details to R. T. Lang.

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Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Spotting Service
c/o Classified Advertising,
AMERICAN MACHINIST
P. O. Box 12, N. Y. 36, N. Y.

Please help us locate the following equipment:

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GRANT

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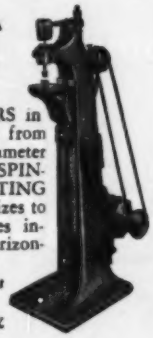
Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.

85 Silliman Ave., Bridgeport, Conn., U. S. A.



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MODEL D

SHORE SCLEROSCOPE HARDNESS TESTERS

Pioneer American Standard

SINCE 1907

Available in Model C-2 direct reading or in Model D dial indicating with equivalent Brinell and Rockwell C Hardness Numbers. May be used free hand or mounted on bench clamp. Sensitive over entire range from softest to hardest of metals without adjustment. Non-injurious to work.

OVER 40,000 IN USE

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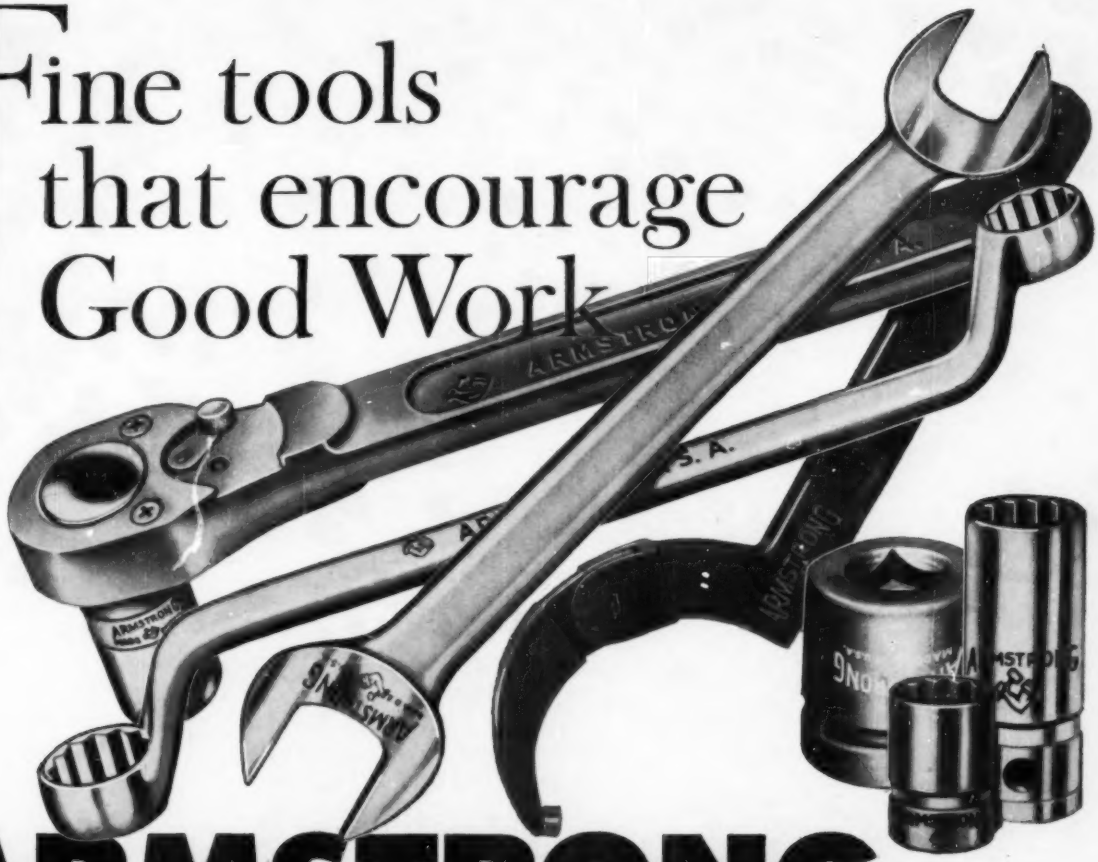

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3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken® bearings

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Cutaway view shows the Dodge All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface —never needs adjustment.

Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

And to get the finest steel for Timken bearings, we make it ourselves—America's only bearing manufacturer that does. So specify bearings trademarked "TIMKEN" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

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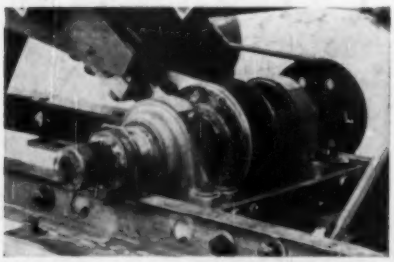

Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.

Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.

Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

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